2007 National Security Space Policy and Architecture Symposium

"Commitment to Space Partnerships"

February 1 -2, 2009

Washington, DC

Agenda

Thursday, February 1, 2007

Keynote Speaker: Back to Basics – Block Acquisition Strategy, The Honorable Ronald M. Sega, Under Secretary of the Air Force

Roundtable Discussion – Managing the Space Enterprise
Moderator: Mr. Hal Hagemeier, Chief Operations, Manager, National Security Space Office
Panelists:

- Lieutenant General Michael A. Hamel, USAF, Commander, Space and Missile Systems Center
- COL (P), Richard F. Matthews, USA, Deputy Commander, U.S. Army Space & Missile Defense Command/ U.S. Army Forces Strategic Command
- Major General John T. Sheridan, USAF, Deputy Director, National Reconnaissance Office
- Dr. Gary Federici, Deputy Assistant Secretary, C4I and Space Programs, Assistant Secretary of the Navy (Research, Development, Acquisition)

Disasters in Space, Mr. Gary E. Payton, Air Force Deputy for Military Space SAF/US(D)

Panel – Turning Architectures into Capabilities

Panelists:

- Major General James B. Armor, USAF, Director, National Security Space Office
- Dr. Steven M. Huybrechts, Director, Space and Principal Director, C3, Space, and Spectrum (Acting), Office of the Under Secretary of Defense (ASD/NII)

Friday, February 2, 2007

USAF Space Summit Discussion
Major General Roger W. Burg, USAF, Director of Strategic Security, Office of the Deputy Chief of Staff for Air, Space and Information Operations, Plans and Requirements, Headquarters, U.S. Air Force

Operationally Responsive Space--Now is the Time to Step-Out Smartly
Mr. Joseph Rouge, Associate Director, National Security Space Office

Panel – The Way Ahead

Panelists:

- Dr. Peter Hays, Associate Director, Center for Space and Defense Studies, U.S. Air Force Academy

S&T Ingredients for the Back to Basics Recipe Brigadier General Duane Deal, USAF (Ret), Director, National Security Space Programs, Applied Physics Laboratory, The Johns Hopkins University

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"Commitment to Space Partnerships"

Ronald Reagan Building and International Trade Center
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‘Commitment to Space Partnerships’

This 9th National Defense Industrial Association (NDIA) National Security Space Policy & Architecture Symposium provides a forum for government and industry stakeholders to develop, strengthen and affirm our current and future directions and partnerships for National Security Space.

The theme of this year’s symposium is “Commitment to Space Partnerships.” This symposium provides the opportunity to hear prominent officials give their views on how strong commitment to partnerships between government and industry, and between government agencies, can successfully address current and future challenges to support the military and intelligence communities from space. Members of Congress, and representatives from the Office of the Secretary of Defense, combatant commands, service space components, and the space industry will discuss their visions and challenges in providing innovative solutions for evolving national security priorities.

Developing and strengthening relationships between government and industry is needed to ensure this Nation’s preeminence in space. The new Presidential National Space Policy, plus a number of very significant organizational changes and provocative global space events since our last symposium make this an especially crucial time to reassess our collective way ahead. Ultimately we must translate this assessment into the enterprise-level space architectures of the Department of Defense, Intelligence Community and civil agencies, and lay the foundation for a robust U.S. space industry. This symposium is intended to be an important venue for government and industry senior leaders to better partner for success in the future.

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7:15 Registration and Continental Breakfast

8:15 Welcome, Introduction and Administrative Remarks
Lieutenant General Dave Vesely, USAF (Ret), Chairman NDIA Space Division

8:30 Keynote Speaker: Back to Basics – Block Acquisition Strategy
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9:00 Space Acquisition
The Honorable Kenneth L. Kreig, Under Secretary of Defense/Acquisition, Technology and Logistics, U.S. Department of Defense

9:30 AFSPC The "Go To" For Space
Major General Mark D. Shackelford, USAF, Director of Plans and Requirements, Air Force Special Command

10:00 BREAK

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12:00 Luncheon & Speaker
Near-term Strategic Imperatives
The Honorable Terry Everett, Chairman, House Armed Services Committee, Subcommittee on Strategic Forces

1:15 Global Trends in S&T and Space
Dr. Lawrence K. Gershwin, National Intelligence Officer for Science & Technology, National Intelligence Council (NIC)

1:45 Disasters in Space
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2:30 BREAK

3:00 Panel – Turning Architectures into Capabilities

Moderator: ***Dr. William F. Ballhaus Jr.***, President and CEO, The Aerospace Corporation

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5:00 Wrap-Up
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5:15 Reception

6:00 Award Dinner & Speaker
Lieutenant General C. Robert Kehler, USAF, Deputy Commander, U.S. Strategic Command

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Dr. William F. Ballhaus Jr., President and CEO, The Aerospace Corporation

Friday, February 2

7:00 Continental Breakfast and Registration

8:00 Opening Remarks
Ms. Catherine Steele, 2007 Symposium General Chair

8:05 Allard Legislation: Independent Review and Assessment of DoD Organization and Management for National Security in Space
The Honorable Wayne Allard, United States Senate

8:45 USAF Space Summit Discussion
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STRENGTH THROUGH INDUSTRY & TECHNOLOGY

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STRENGTH THROUGH INDUSTRY & TECHNOLOGY

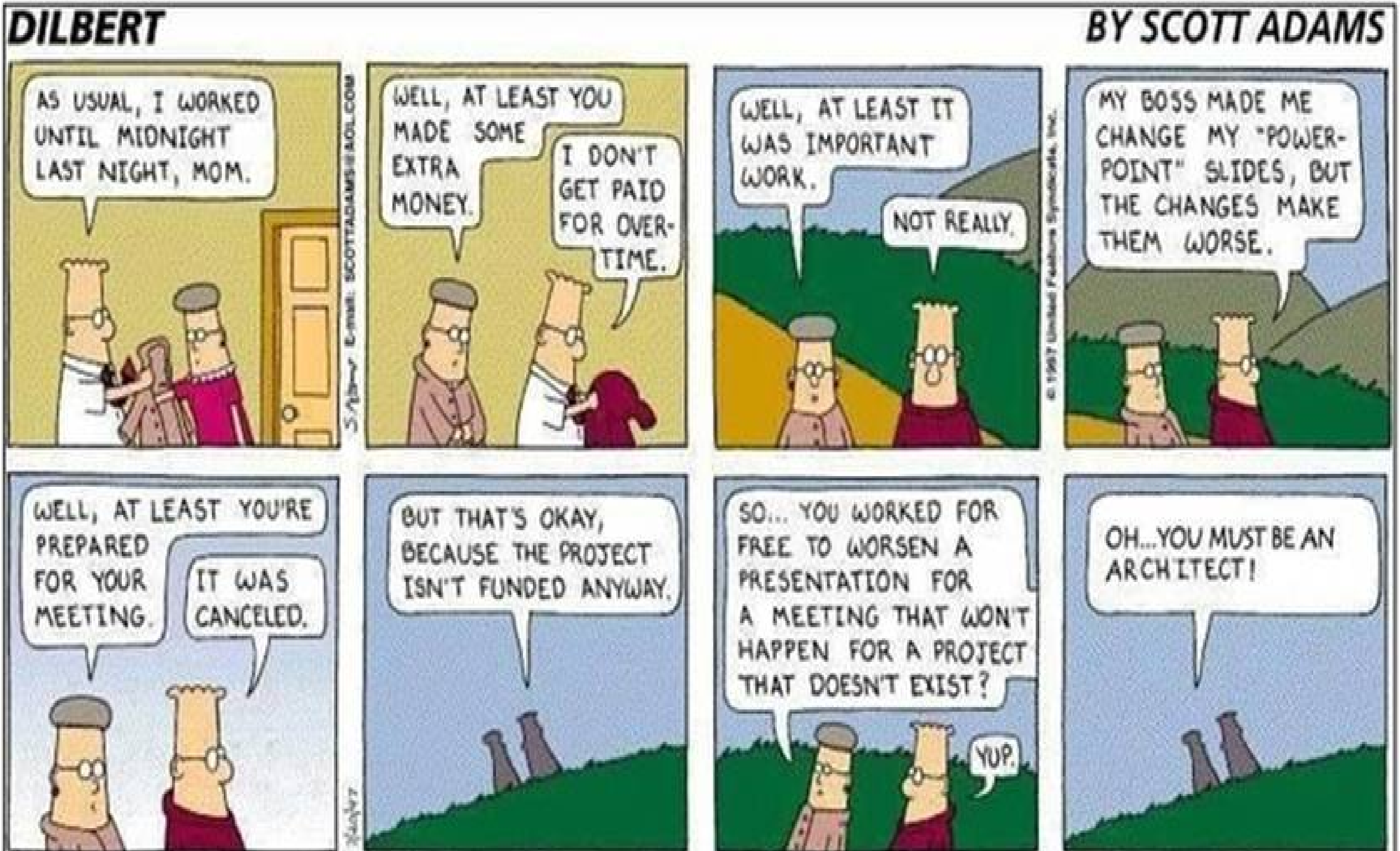
National Security Space Office

Turning Architectures into Capabilities

National Security Space Policy and Architecture Symposium

Maj Gen James B. Armor, Jr

1 February 2007


DILBERT
BY SCOTT ADAMS
AS USUAL, I WORKED UNTIL MIDNIGHT LAST NIGHT, MOM.
WELL, AT LEAST YOU MADE SOME EXTRA MONEY.
I DON'T GET PAID FOR OVER-TIME.
WELL, AT LEAST IT WAS IMPORTANT WORK.
NOT REALLY.
MY BOSS MADE ME CHANGE MY "POWER-POINT" SLIDES, BUT THE CHANGES MAKE THEM WORSE.
WELL, AT LEAST YOU'RE PREPARED FOR YOUR MEETING.
IT WAS CANCELED.
BUT THAT'S OKAY, BECAUSE THE PROJECT ISN'T FUNDED ANYWAY.
SO... YOU WORKED FOR FREE TO WORSEN A PRESENTATION FOR A MEETING THAT WON'T HAPPEN FOR A PROJECT THAT DOESN'T EXIST?
YUP.
OH...YOU MUST BE AN ARCHITECT!

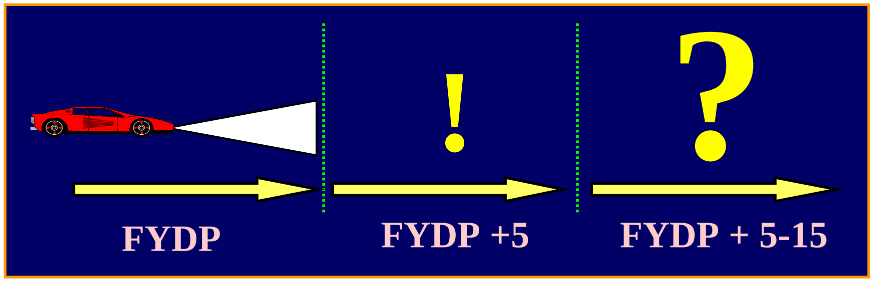
National Security Space Office (NSSO) Background

- NSSO primary roles:
  - Staff Support to DoD Executive Agent for Space
  - NSS Architect (NSSA)
- NSSA established by 1998 MOU for NSS Management between SecDef (Cohen) and DCI (Tenet)
  - "Ensure activities are closely coordinated and architectures are integrated to maximum…"
- Support Decision-making

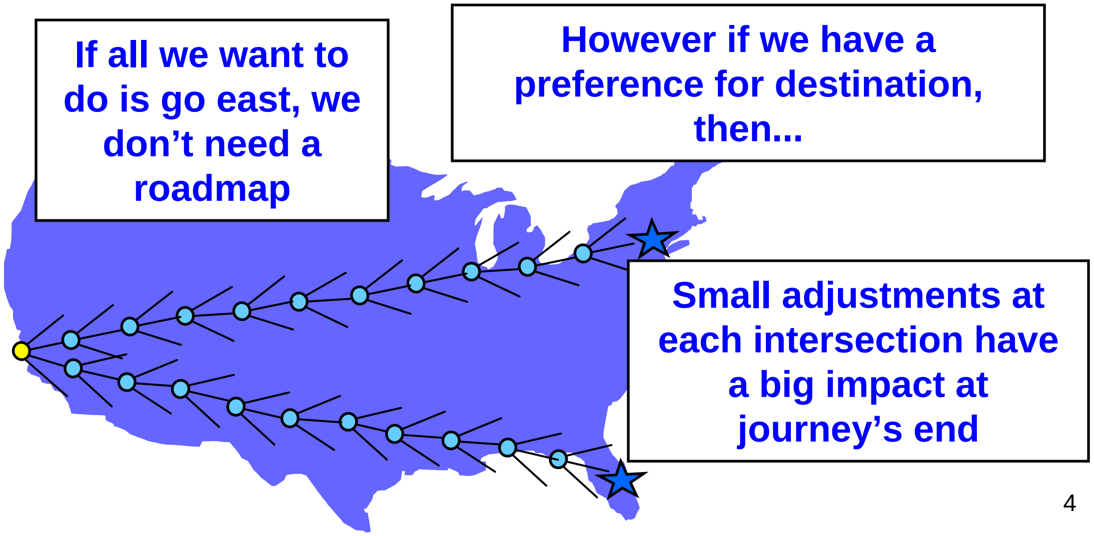
Architectures:
What they are and aren't

- **Provide framework and context**
  - Much like city planning
  - Versus designing a specific building

- **Recommendations that guide long term actions**
  - Focus on ultimate destination
  - Versus the next exit & meal stops or what's within range of the headlights



- **Characteristics or objectives that influence decisions**
  - Allows flexibility in moving towards objective
  - Versus specific system implementations

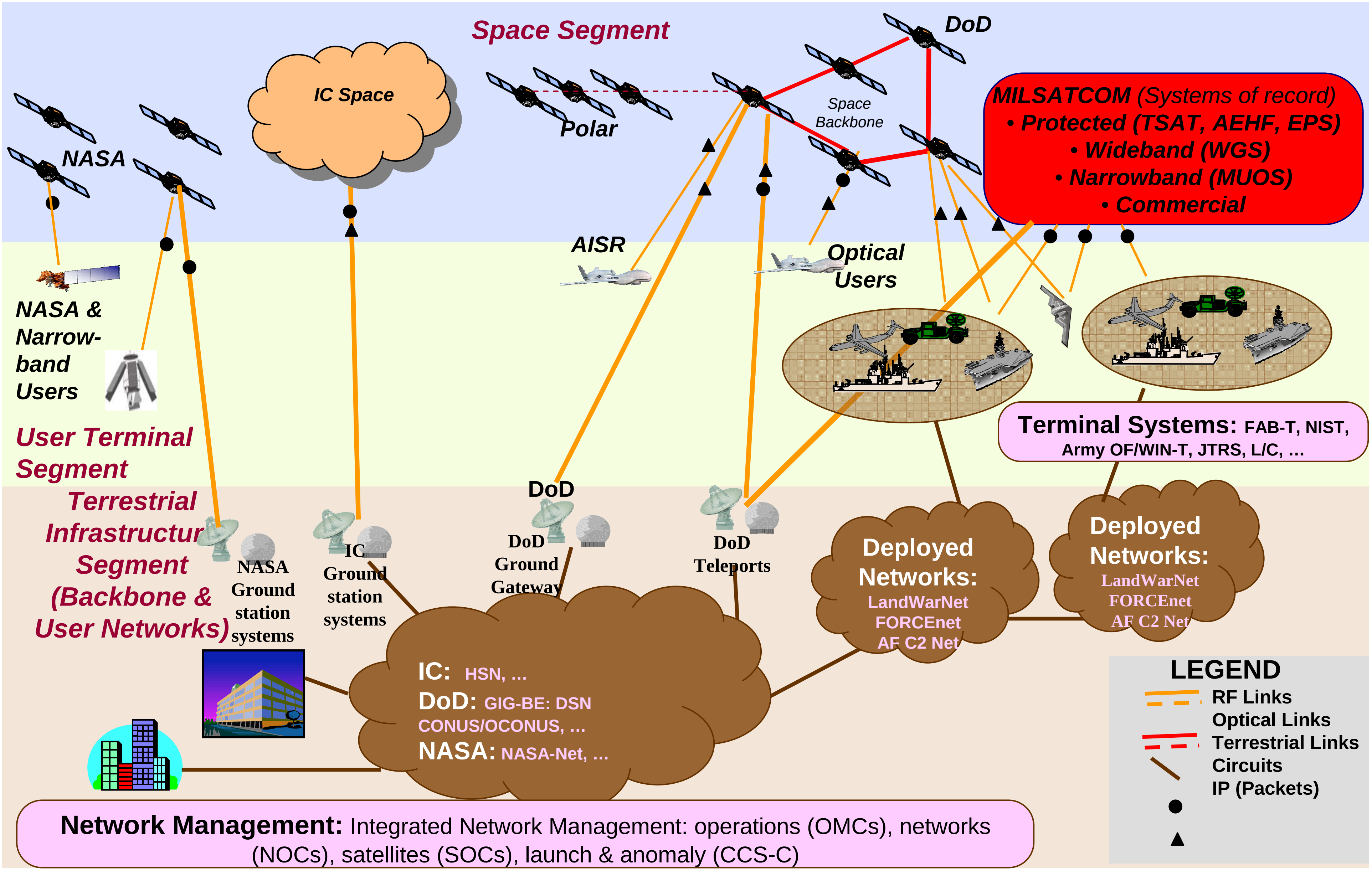


Architectures: What makes them successful

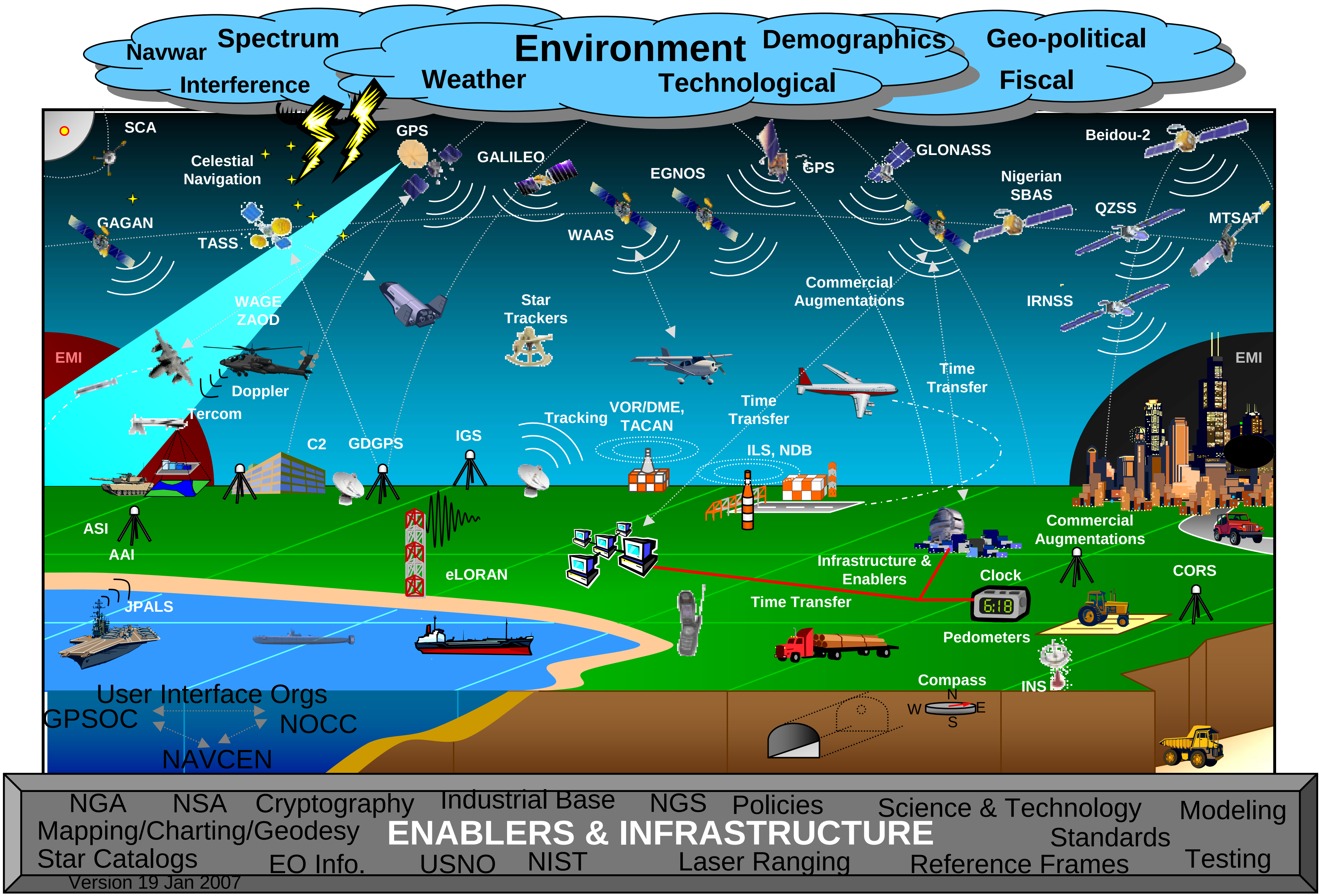
- Context
  - End to end mission, all platforms
  - Interfaces with other missions and mediums
- Dynamic
  - Continuous assessment to address “facts of life”
- “Enforceable”
  - Enough detail to support implementable decisions
- Transparent
  - Impartial build of “should be” architecture
- Senior leadership participation
  - Agreed evaluation criteria
  - Organizational data sharing

SATCOM Architecture

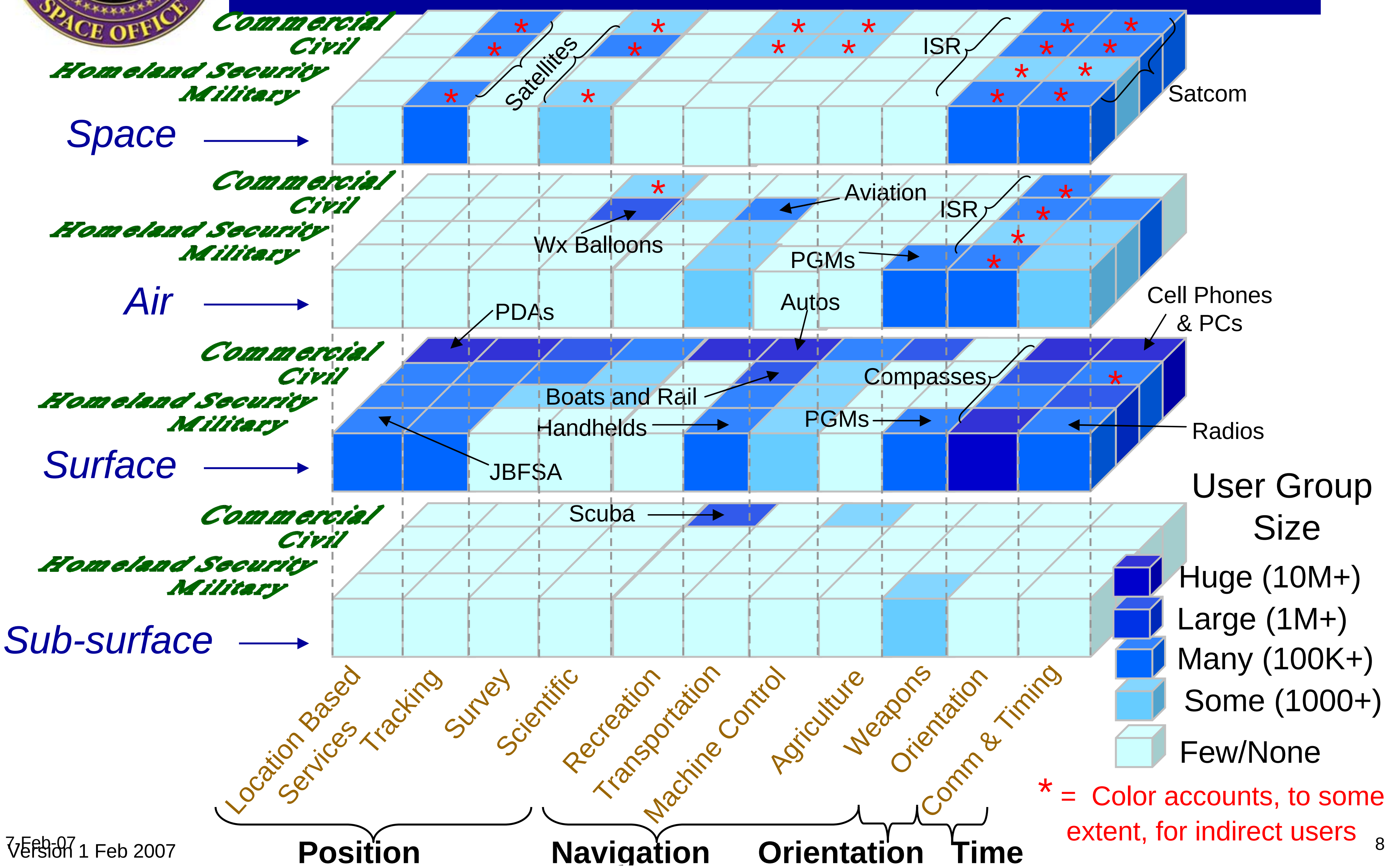
TCA Version 2.0



Position, Navigation, and Timing (PNT)
Evolved Baseline (2025) - Operational View

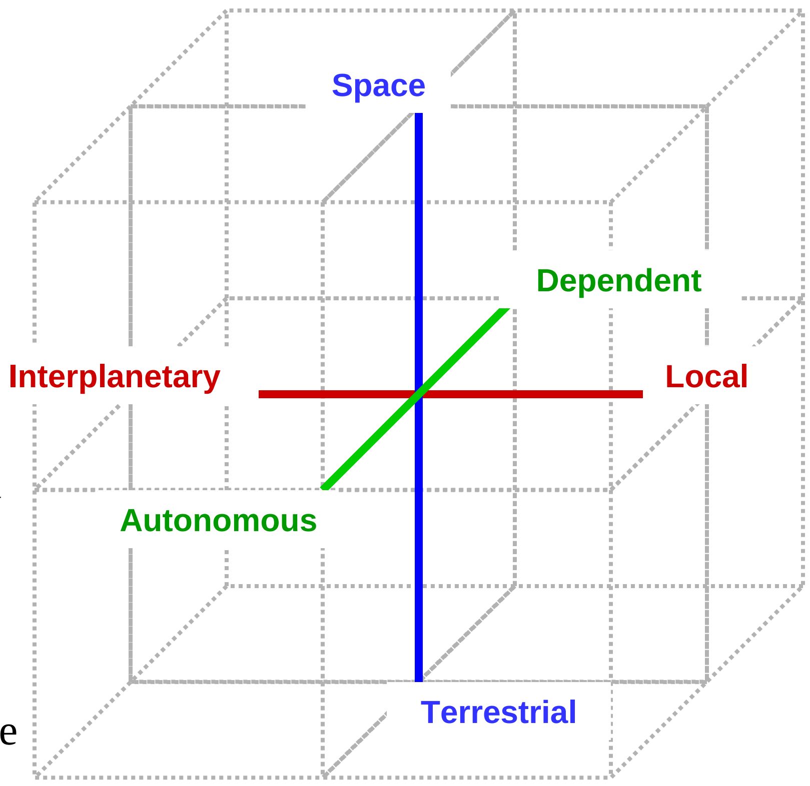


PNT User Perspectives (2025)



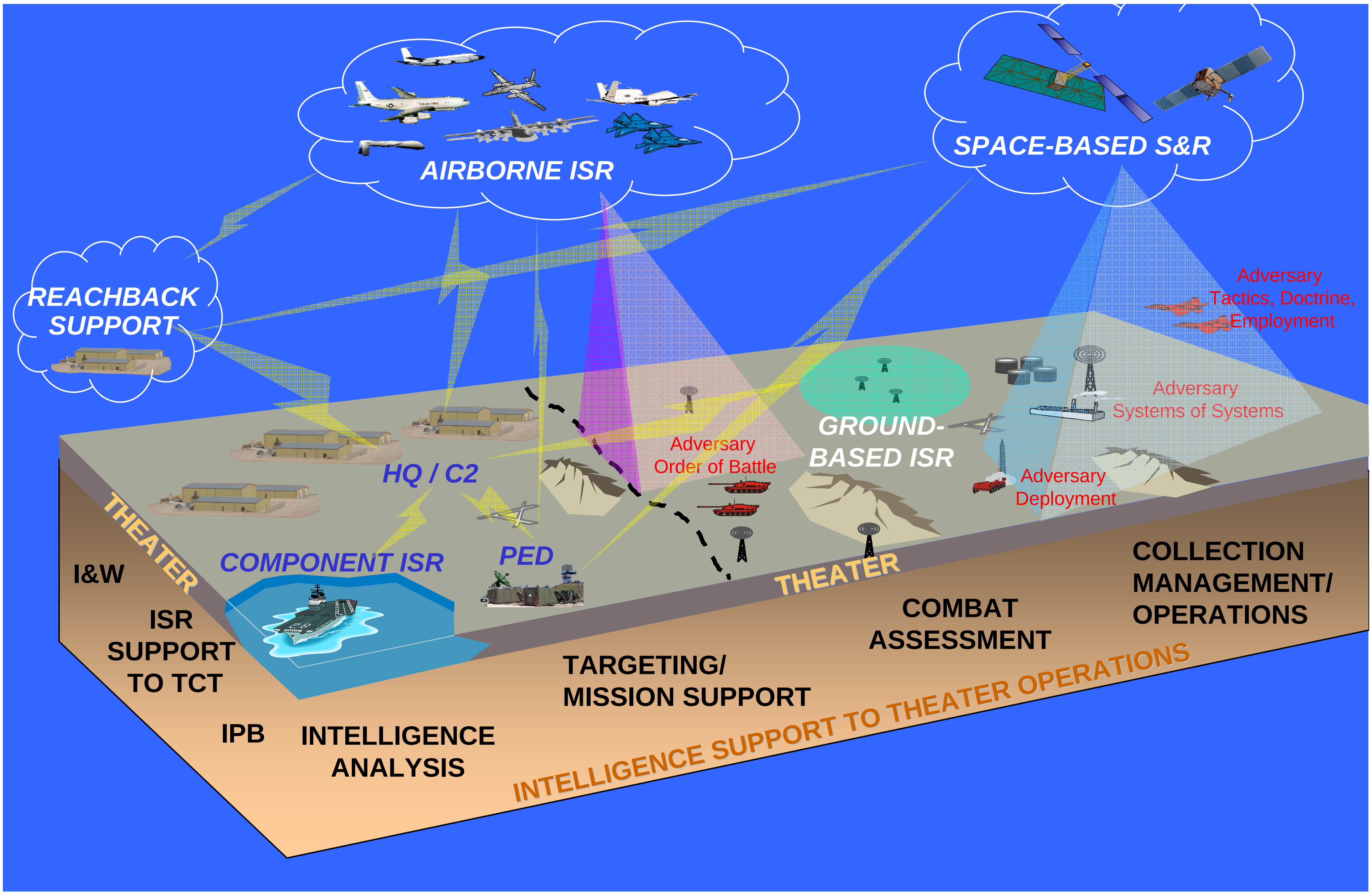
PNT Architecture Trade Axes

- **Source Location** (of the service provider)
  - Terrestrial: concept provides service from, near, or beneath the surface of the earth
  - Space: concept provides service from space
- **Service Volume** (of the service provided)
  - Local: concept provides a meaningful service only at a fixed point
  - Interplanetary: concept provides a meaningful service throughout the solar system
- **Autonomy** (of the user)
  - Dependent: concept requires frequent refresh of information from external sources to provide a meaningful service
  - Autonomous: concept, once initialized, is self-contained; requires no refresh of info from external sources to provide meaningful service

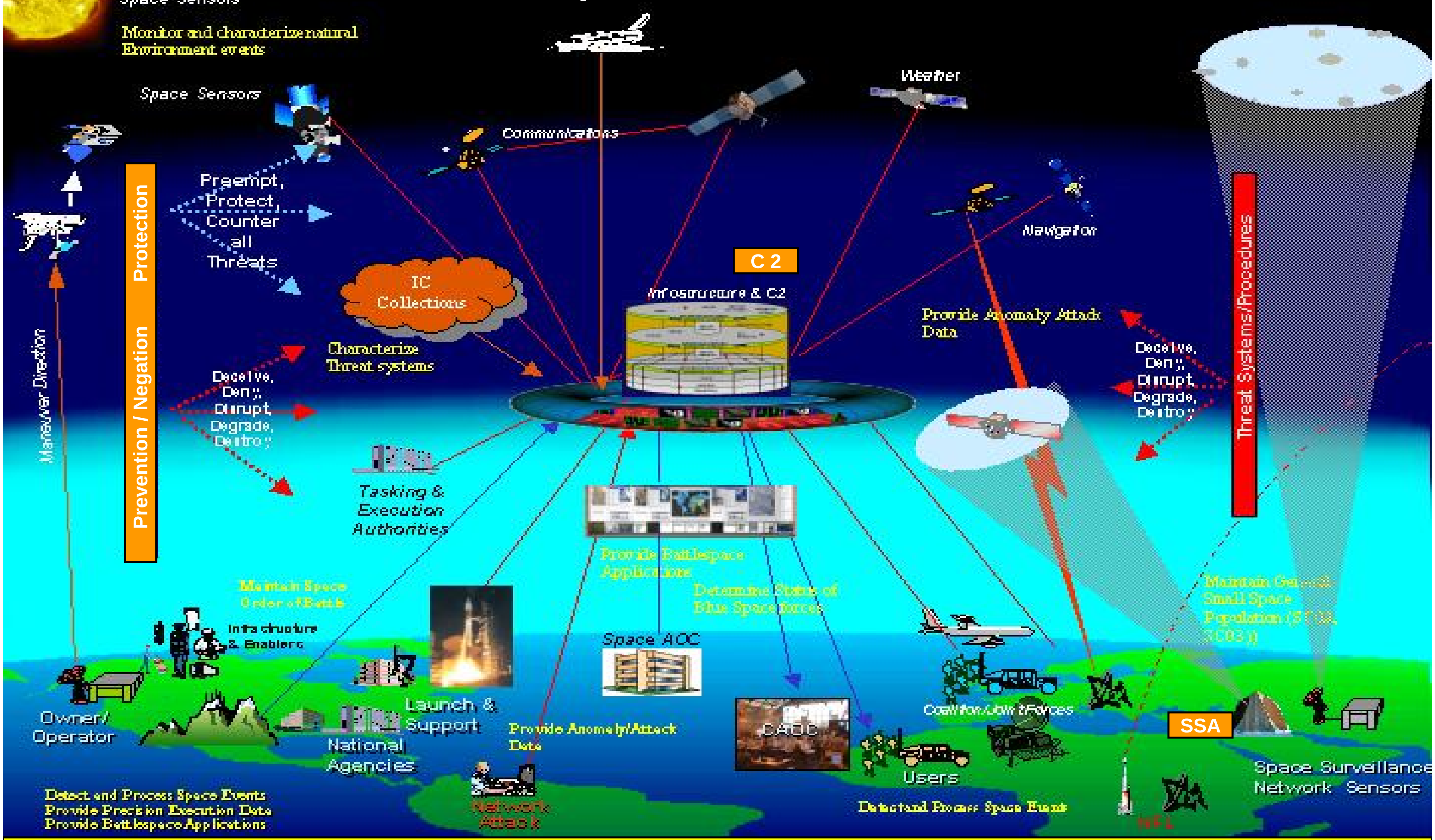


TRADE AXES ENSURE CONSIDERATION OF A FULL RANGE OF ARCHITECTURAL OPTIONS

Intelligence, Surveillance, and Reconnaissance (ISR) Architecture



Space Control



Assuring access to Space for US & Allied Forces
Denying access to our Adversaries

Summary

- Vision and planning across the community is needed to maintain US preeminence

- Build the bridge from both sides

It's time to stop acting "systems" and start acting architectures

2006 Space Summit

U.S. AIR FORCE

Major General Roger W. Burg
Director of Strategic Security

Space Summit – 7 Sep 06

- **Attendees: A select list of eighteen current and former senior AF leaders and AF space experts**

- **Why hold a Space Summit?**
  - **Provide CSAF a forum of experts to identify issues and develop a path towards the future of the Air Force in space**
  - **Demonstrate the Air Force's commitment to being the nation's leader in military space**

- **Entering Argument:**
  - **Review of AF's stewardship of space by two senior mentors**
  - **<u>Unvarnished</u> assessment of challenges and successes**

Not an attempt to solve problems, but to identify the right questions … and find the path that leads to right answers.

Topics Discussed

- Organizational Roles and Missions / Space Policy
  - Examine/clarify space missions in Joint and AF Policy/Doctrine/CONOPS
  - Communicate space missions across AF and to the public
- Space Cadre and Professional Development
  - Assess career paths for Officer and Enlisted Space Professionals
  - Correctly balance Air and Space in Professional Military Education
- Organizational Construct / Mission Partners
  - Organize STRATCOM / CSAF Staff talks
  - Develop strategy and investment plan to put JSpOC on par with other AOCs
  - Assess NRO / USAF Relationship and Statement of Intent
  - Assess intelligence manning and expertise to support JFCC-Space
- Space Systems Acquisition
  - Streamline acquisition process; return Space Acquisition Executive to AF
  - Examine performance metrics for evaluating systems engineering
  - Evaluate AFSPC/CC's role within acquisition lines of authority

Results to date

- Strategic Communication Plan for Space published by SAF/PA
- AF Doctrine Center leading forum to review space missions and doctrine
- Engagement with Combatant Commands
  - STRATCOM / CSAF Staff Talks – Spring 2007
- Revalidated AF / NRO Relationship
  - Closely working together on operations and personnel
- Space Training
  - Authority to approve Counterspace training delegated to SECAF
- Space Professional career path
  - Comprehensive review underway

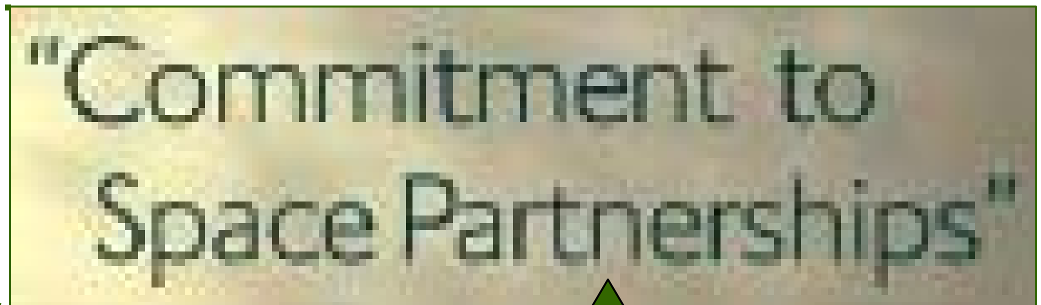
9th National Security Space Policy & Architecture Symposium

"S&T Ingredients for the Back to Basics Recipe"

DUANE DEAL
The Johns Hopkins University
APPLIED PHYSICS LABORATORY

The right idea …

The right idea …



That's what it's all about!

Overview

- Peeking at what’s happened -- the environment
- The right recipe: “Back to Basics”
- A few S&T perspectives & credentials (via a “1-Person Panel”)
- Applying S&T capabilities to the end-to-end cycle
- Summary

Theme

If --

"Back to Basics" is the question …

Then --

a government, industry, & lab mix
is the best answer.

NATIONAL DEFENSE INDUSTRIAL ASSOCIATION
STRENGTH THROUGH INDUSTRY & TECHNOLOGY

9th National Security Space Policy & Architecture Symposium

Peeking at what's happened:

The environment via 20-20 hindsight

External environment

The Washington Post

Military Ordered To Trim Budgets

5-Year Plans Must Be Cut By $32.1 Billion

By Renae Merle and Bradley Graham, Washington Post Staff Writer

….

Thus, **the cuts are expected to come at the expense of expensive weapons programs** such as Lockheed Martin Corp.'s F-35 Joint Strike Fighter and the DD(X) destroyer being developed by Northrop Grumman Corp. The military's procurement and research and development programs, from which defense companies most of their profits, are considered vulnerable, **especially those that are behind schedule or over budget.**

DefenseNews

U.S. MDA May Cut $1B Over 5 Years

By Gopal Ratnam

The Pentagon's Missile Defense Agency (MDA) proposes to axe nearly $1 billion from its five-year budget plan to satisfy the Defense Department's budget priorities.

…. the MDA will cut $955 million from its 2007-11 plan to meet Pentagon budget goals set out in an Oct. 19 directive from Gordon England, acting U.S. deputy secretary of defense. England's memo ordered agencies to find $32.1 billion in cuts for 2007-11....

The Space Review

essays and commentary about the final frontier

The US Navy: lost in space?

by Taylor Dinerman

The cost and engineering problems the Air Force is having with their space programs and in trying to train a solid cadre of qualified and effective space personnel are all too familiar. Now it seems that, on a smaller scale, the Navy is stuck with a similar dilemma. This problem could become more serious in the future since, unlike the Air Force, the senior Navy leadership may not even be aware that there is anything wrong.

….

Aviation Week's Aerospace Daily & Defense Report

AF Space Program Woes Hurting Army Capabilities

COLORADO SPRINGS, Colo. -- The commander of the U.S. Army Space and Missile Defense Command expressed concern on Jan. 24 about cost and schedule troubles in Air Force space programs, saying they have a negative effect on Army capabilities and reduce the confidence of Pentagon officials in Army programs.

SPACE NEWS

GAO Says U.S. Air Force Has More Space Than It Can Handle

By JEREMY SINGER

Space News Staff Writer

WASHINGTON – The U.S. Air Force has started more space programs than it can afford, setting itself up for disruptive funding cuts and schedule delays, according to a government audit report delivered to Congress June 23. ….

-Trying to make technological leaps that are too difficult with next generation systems.

….

-Lack of a qualified workforce to support space acquisition programs. ….

SPACE NEWS 19

September 19, 2005

Acquisition Lost in Space

< REP. TERRY EVERETT (R-ALA.) >

Recently, some have suggested that we have done enough to fix the acquisition problems of the Department of Defense; we now must let the roots take hold and wait for it to bear fruit. While it is true that the department started to move in the right direction, enough has not yet been done. Our nation's defense acquisition system is still "Lost in Space."

The nation's acquisition process is in poor shape and nowhere is that more apparent than in the development of our national security space assets. For example, program managers for the National Polar-orbiting Experimental Satellite System recently notified the House Armed Services Committee of its first breach of the Nunn-McCurdy Act, a law that requires congressional reporting for acquisition programs whose costs grow 15 percent, and mandates program recertification for those acquisition programs whose costs grow 25 percent or more.

The Space Based Infrared System-High recently experienced its second breach in as many years, notifying the committee of a cost growth exceeding 40 percent. Additionally, the Evolved Expendable Launch Vehicle and the Advanced Extremely High Frequency programs both experienced breaches over the last 18 months. Further, several intelligence collection satellites are multiple billions of dollars over budget and several years late in fielding their intended capability.

We can and must do more. Our investment in space is far too important for our economic and military well-being to take this lightly. To achieve success, we must continue to focus our attention on four key areas:

- Poor cost estimating and budgeting;
- Lack of systems engineering expertise;
- Lack of investment in acquisition professionals; and,
- Poor subcontractor management.

I will explain the nature of the problem and describe solutions that we must continue to execute.

Poor cost estimating has plagued every new national security space program since the Milstar program. Moreover, acquisition reform during the 1990s included significant manpower reductions, shrinking the acquisition workforce by more than 50 percent and affecting the cost estimators much harder than that. The Air Force went so far as to get rid of the cost estimation duty-specialty for its personnel, subordinating it as an additional duty.

The expertise and knowledge of these professionals were allowed to waste away. As a result, neither industry nor the government has a system of checks and balances to maintain reality in or accountability for their cost estimates.

Secondary consequences allowed the manufacturing of cost estimates for the purposes of winning an industry bid or, in the case of government, getting buy-in to meet larger service budgetary constraints. Programs were destined for significant overruns before they ever started.

The solution: Increase the number of cost estimators, rebuild and reward their skills and expertise, ensure their independence from the program offices, and develop realistic budgets that incorporate the Defense Science Board recommendation to budget at the 80-percent confidence level rather than the current practice of budgeting to the 50-percent confidence level.

The blind pursuit of "faster, better, cheaper" during previous acquisition reform attempts ruined the government's systems engineering, while a lack of a national effort to celebrate math, sciences and the future use of space in our education crimped the pipeline that creates the nation's engineers.

A lack of vision for the future of space failed to inspire the nation's youth to join its ranks. Further, past acquisition reform reduced the number of government engineers and forced those remaining to depend on industry to do their jobs for them.

Again, as in the case of cost estimators, the numbers as well as the knowledge and expertise of our engineers diminished to dangerously low levels, allowing shoddy work and poor quality control. In order to achieve success, engineers faced steep learning curves and unrealistic workloads. They were set up for failure from the beginning.

The solution: Increase the number of engineers, build and reward their skills and expertise, and continue to build and communicate a vision for the future of space, similar to the president's plans for space exploration.

Past attempts at acquisition reform and the culture of the military services have resulted in an underinvestment in Department of Defense acquisition professionals. The drastic downsizing of the acquisition workforce has had far reaching impacts. In the Air Force, despite handling more than 70 percent of the total Air Force budget and developing 100 percent of the weapons systems in use, acquisition professionals are often treated as second-class citizens.

Promotion rates are generally lower than their peers on other career paths. Opportunities for command are often nonexistent. Training and career development for acquisition professionals is inadequate and out of date.

The solution: Make these professionals a priority. Ensure adequate promotion rates and command opportunities for the acquisition workforce, while addressing the shortcomings of the associated training and development of their careers. Establish a culture that values the contributions of these professionals.

Due to the consolidation of the defense industry, only three prime contractors remain to bid on national security space projects. Therefore, a prime contractor must manage anywhere from eight to 12 subcontractors. Unfortunately, sufficient accountability does not exist in today's acquisition system.

Subcontractors and suppliers have been allowed to grow careless with inadequate and unfocused leadership from the prime contractors. Countless horror stories exist about needless contamination of parts, frequent rework of subcomponents, nonexistent communications between and among systems developers, and lack of manufacturing discipline. For example, the prime contractor of a current intelligence collection program experienced four separate problems on the same part before seeking a new subcontractor.

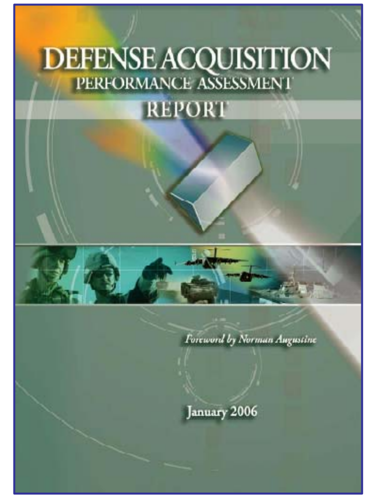
The solution: Create accountability and exert leadership. The prime-sub relationship should be closely managed.

Contracts should be awarded either to the concept with a manageable number of subcontractors or structured to provide sufficient incentives and penalties required to ensure proper performance. Government representation in the contractor factories must once again be instituted in order to ensure quality control and provide oversight.

The acquisition challenges of national security space are critical from both a fiscal and operational context. As such, it is important that we not lose momentum in this endeavor. There is far more work remaining to remedy our acquisition system. These solutions will take us a long way toward that goal.

Rep. Terry Everett represents the 2nd Congressional District of Alabama in the U.S. House of Representatives and is the chairman of the House Armed Services subcommittee on strategic forces and a member of the House Armed Services subcommittee on tactical land and air forces, and the Veteran's Affairs subcommittee on oversight and investigations. He also is vice chairman of the House Permanent Select Committee on Intelligence technical and tactical intelligence subcommittee, and is a member its oversight subcommittee.

- Cited prominent examples
  - Cost tripled, delays
  - Complex technology … not sufficiently prototyped



- Emphases:
  - Timing as a Key Performance Parameter (KPP)
  - Budget to most realistic cost estimates; contract similarly (or be unexecutable from square one)
  - Choose low risk solution over best value; reward for adhering to schedule versus only paying for performance

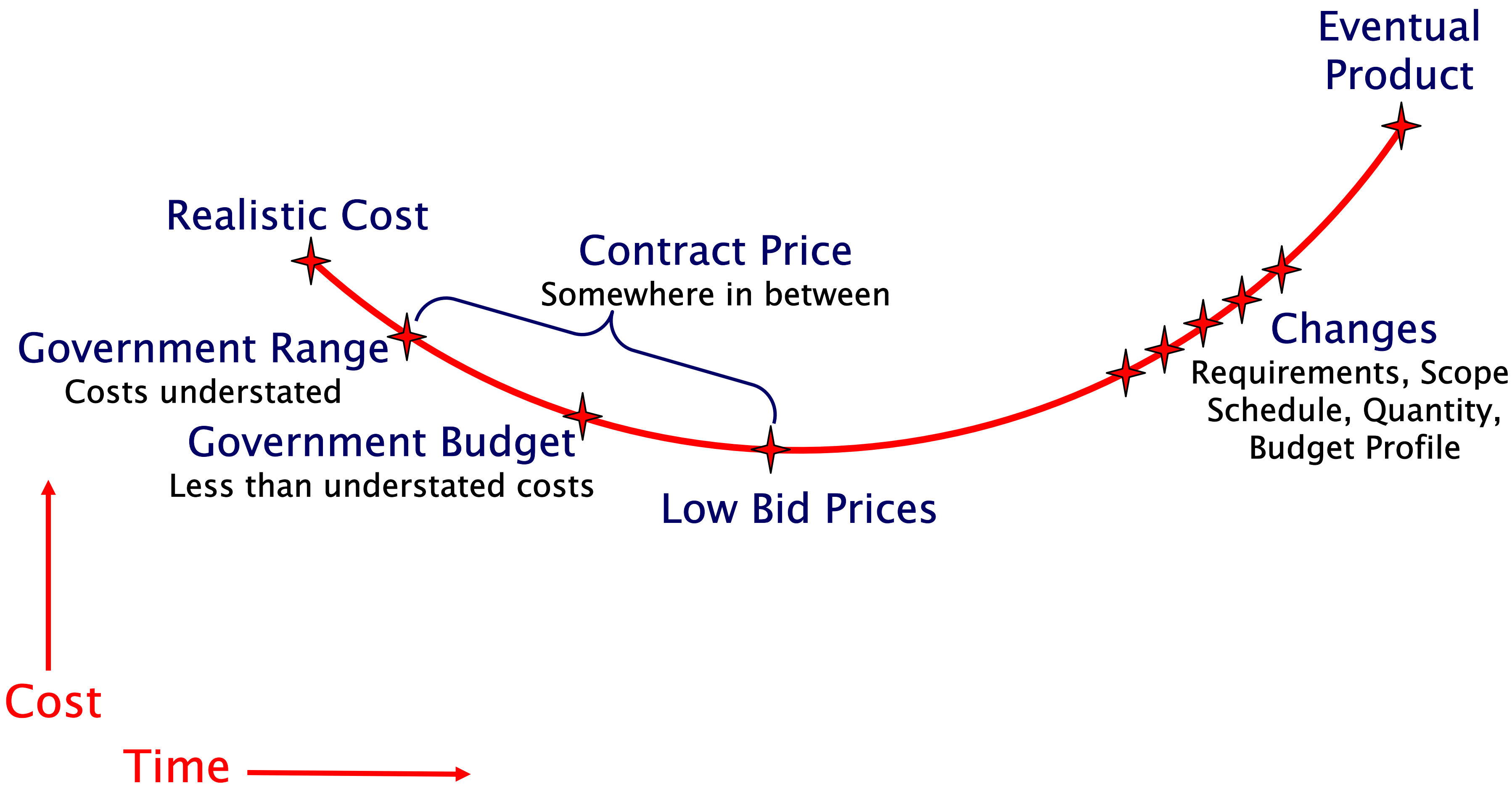
Another independent view

Addressing National Security Space problems

Ref: *"What Went Wrong in National Security Space?,"* remarks to Space Enterprise Council, U.S. Chamber of Commerce, by Loren Thompson, COO Lexington Institute, 13 Sep 05)

- Study revealed not-so-surprising major problems:
  - Unplanned <u>cost growth</u>
  - Excessive/unrealistic performance <u>requirements</u>
  - Poor <u>management</u> practices
  - High <u>workforce</u> turnover
- *NSS Acquisition Policy 03-01*
  - Demands rigorous approach to technical baselines & performance requirements
  - <u>Mandates early testing</u> of critical components

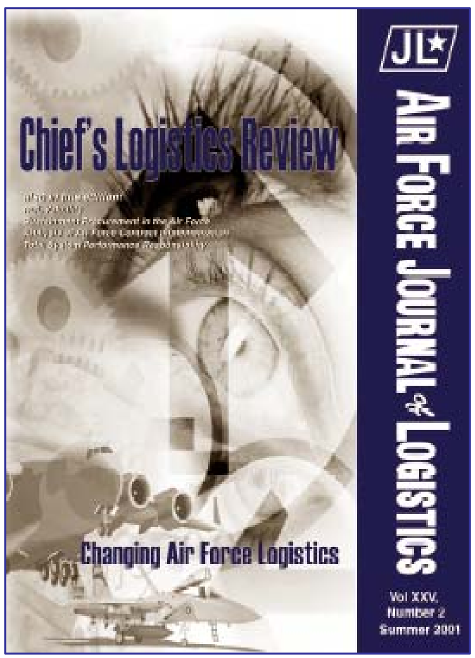
The Cost "Axis of Evil"



The TSPR road

"We expect to achieve greater successes from every person, dollar, and hour we expend to acquire and sustain our current and new weapon systems."

Darleen Druyun
(then) Principal Deputy Assistant Secretary of the Air Force for Acquisition and Management



"The TSPR approach addresses General McPeak's assessment of acquisition and seeks to turn failures into successes …

TSPR is certainly more than a passing catchy phrase or acronym …. "

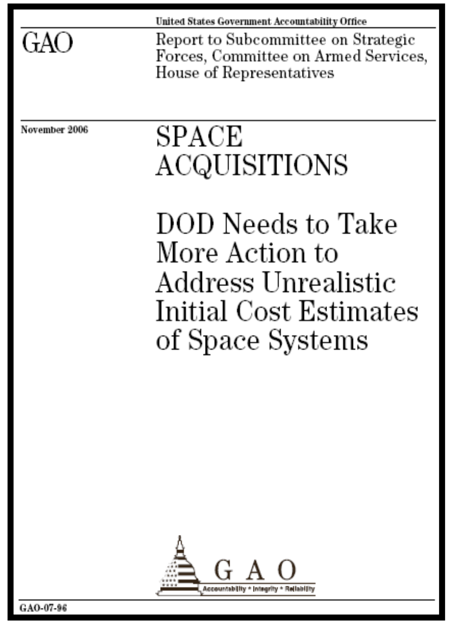
Air Force Journal of Logistics
Summer 2001

The TSPR road dead-ends[1]

Military Aerospace Technology
15 Nov 2004 in Volume 3, Issue 3
Interview with Lt. Gen. Brian A. Arnold
(then) Space and Missile Systems Center Commander

"…. space programs will continue to be challenging by their very nature. As a result of a decade or more of acquisition reform and the Total System Program Responsibility [TSPR] concept, … less government oversight led to less insight, and any initial cost savings due to manpower savings became cost overruns. We have eliminated TSPR as a process."

The TSPR road dead-ends$_2$


United States Government Accountability Office

GAO

Report to Subcommittee on Strategic Forces, Committee on Armed Services, House of Representatives

November 2006

SPACE ACQUISITIONS

DOD Needs to Take More Action to Address Unrealistic Initial Cost Estimates of Space Systems

GAO-07-96

November 2006

"Total System Performance Responsibility, or TSPR--was intended to facilitate acquisition reform and enable DOD to streamline a cumbersome acquisition process and leverage innovation and management expertise from the private sector. However, DOD later found that this approach magnified problems related to requirements creep and poor contractor performance."

"If you do not know where you are going, any road will take you there."

Cheshire Cat in *Alice in Wonderland*

NATIONAL DEFENSE INDUSTRIAL ASSOCIATION
STRENGTH THROUGH INDUSTRY & TECHNOLOGY

9th National Security Space Policy & Architecture Symposium

The Right Recipe: "Back to Basics"

"Preventing recurring nightmares"

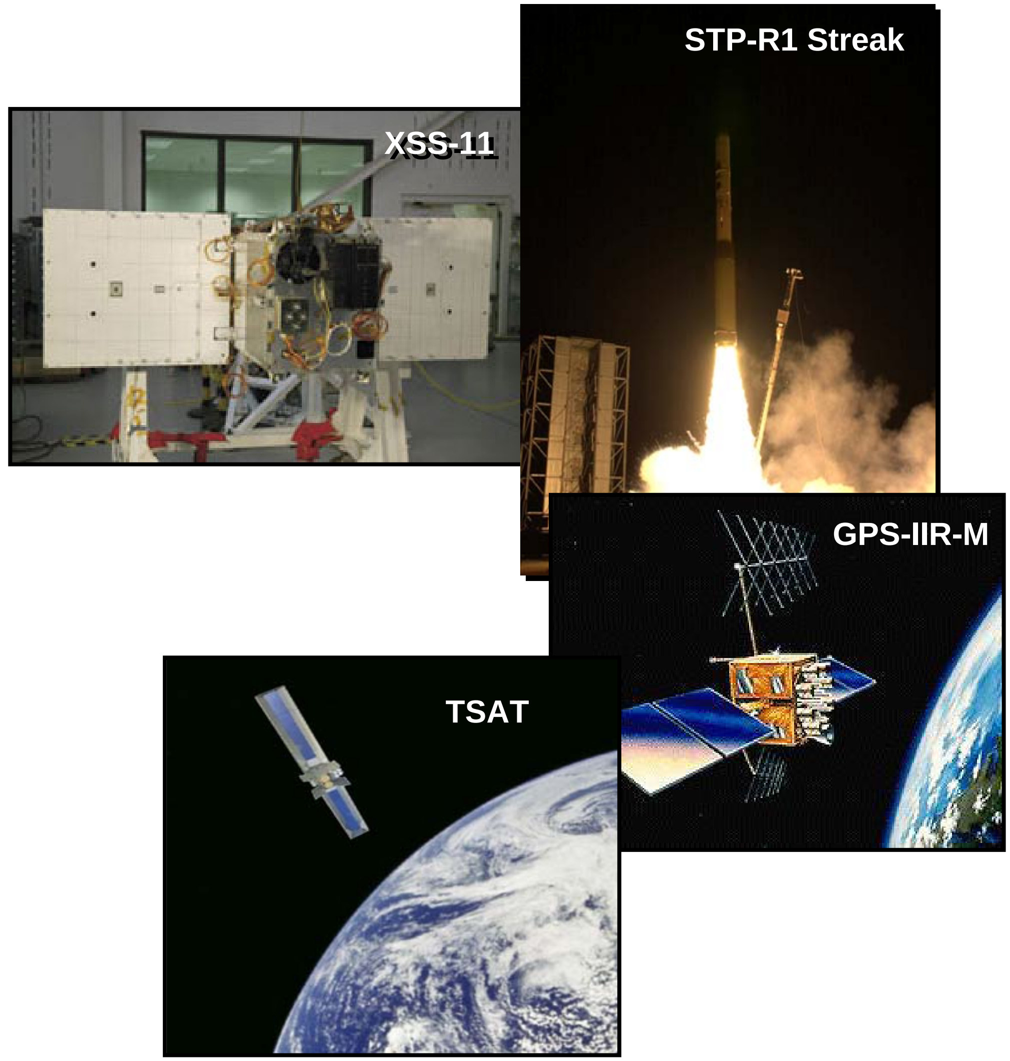
"Change is inevitable.
Growth is optional."

Walt Disney

NOTE: Presented by USecAF Sega,
National Space Symposium, 5 Apr 06
Strategic Space & Defense, 11Oct 06
NDIA Symposium, 1 Feb 07

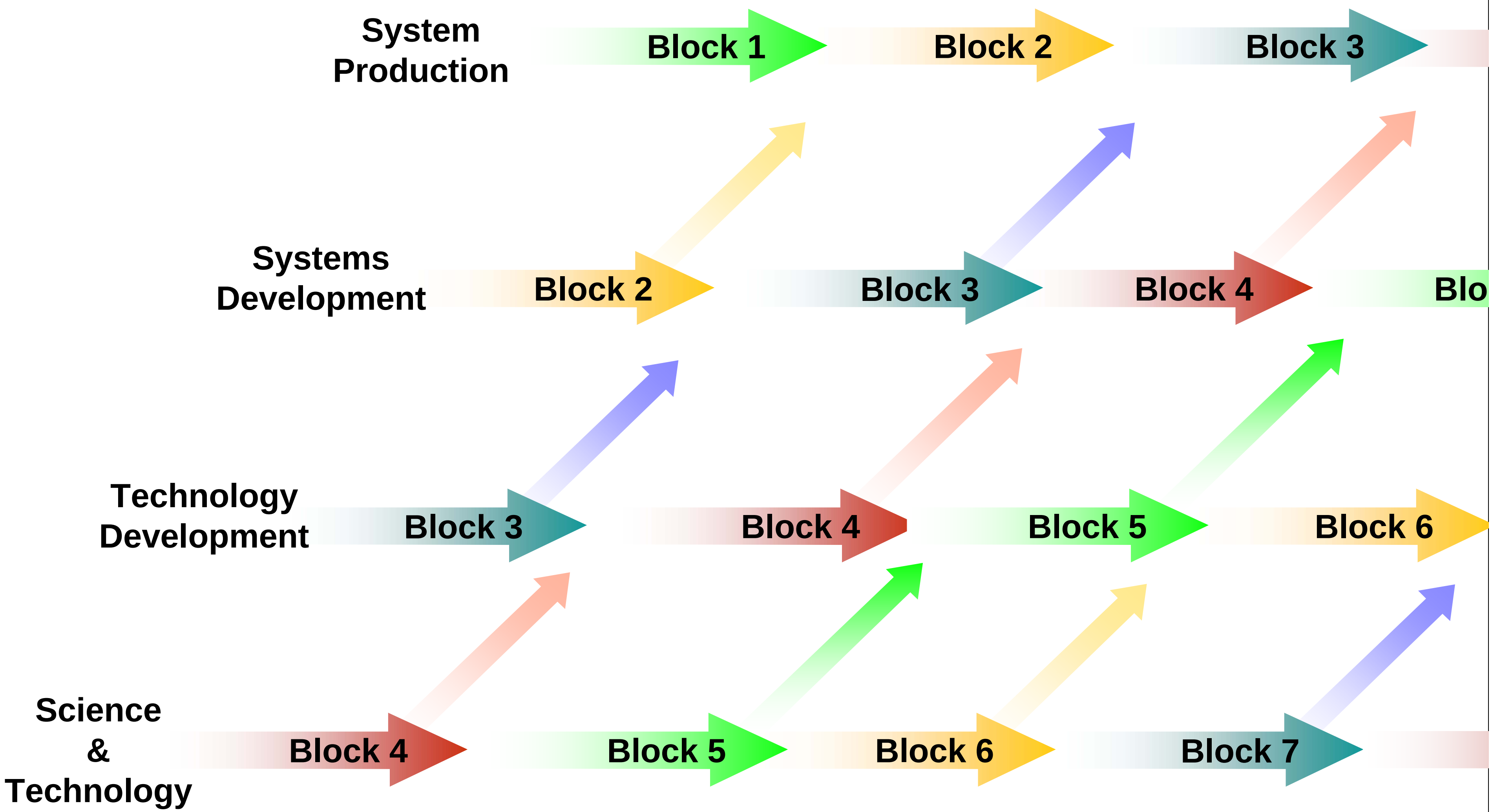
Back to Basics in Acquisition

- Four-stage process
  - System Production
  - Systems Development
  - Technology Development
  - Science & Technology
- Reapportion Risk
  - Lower risk in Production
    - Use mature technology
  - Higher risk in S&T



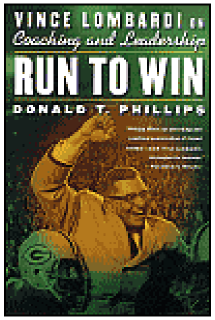
NOTE: Presented by USecAF Sega,
National Space Symposium, 5 Apr 06
Strategic Space & Defense, 11Oct 06
NDIA Symposium, 1 Feb 07

Acquisition Stages—Block Approach



Integrity - Service - Excellence

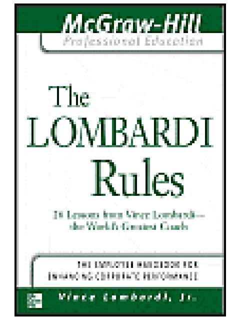
Back to Basics



aka

"Focus on Fundamentals."

Vince Lombardi



- Addresses DAPA concerns
  - Complex technology not sufficiently prototyped … timing … low risk solutions … schedule
- Addresses independent assessments
  - GAO
    - Mature technology, funding stability, requirements, schedules
  - *NSS Acquisition Policy 03-01*
    - Early testing, baselines, requirements, evolutionary acquisition
  - Lexington Institute
    - Risks, schedule, requirements, cost growth
- Confirms "TSPR R.I.P."
- Addresses QDR requirements
  - New acquisition policies, procedures, and processes

NATIONAL DEFENSE INDUSTRIAL ASSOCIATION

STRENGTH THROUGH INDUSTRY & TECHNOLOGY

9th National Security Space Policy & Architecture Symposium

Mitigating risks, preventing "disasters" --

A few S&T perspectives

"Been there, doing that"

AFRL, NRL, Draper, SDL, & APL

AFRL Space S&T for Risk Reduction

- USECAF Block Approach: vigorous experimentation to reduce risk
- AFRL Space Vehicles Directorate is embracing this philosophy
  - Strong program in space experimentation
  - 8 major flight experiments on docket
- AFRL legacy space S&T for risk reduction -- examples:
  - CRRES – microelectronics & space sensor risk reduction
  - APEX – solar cells and microelectronics risk reduction
- Current AFRL space S&T for risk reduction -- examples:

Major Experiments

- RR-AIRSS – Risk Reduction - Alternate IR Satellite System
- TacSat series – small satellites with tactical utility

Component Technologies

- Solar cells
- IR detectors and read-outs
- Cryocoolers
- Space electronics

Examples of AFRL Space S&T for Risk Reduction

RR-AIRSS: Risk Reduction - Alternate IR Satellite System

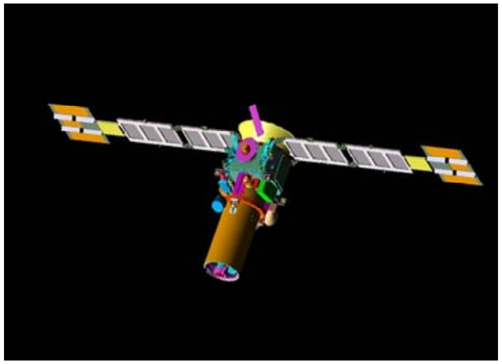
- OSD/AT&L mandated AIRSS program to provide hedge against further difficulties with SBIRS GEO satellites
- SMC & AFRL using USECAF Block Approach to reduce AIRSS risk
- Develop, build, and flight qualify wide-field-of-view, full-Earth staring sensor
- FX-AIRSS flight experiment: investigate data processing & full-Earth backgrounds
  - Seeking FY10 launch to GEO

Wide-Field-of-View

Full-Earth Staring Sensor

TacSats and Operationally Responsive Space

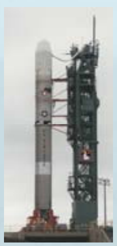
- ORS S&T mandated by Congress
- Mission: timely satisfaction of JFC needs
- S&T goal: mature technology to TRL 7
- ORS S&T Roadmap to guide S&T
- TacSat-2: launched on 16 Dec 06
  - Panchromatic imager
- TacSat-3: launch in 2008
  - Hyperspectral imager



TacSat-2

Naval Research Lab has a Long History Developing New Space Capabilities with Major Operational Impacts

- **NRL Has a Long and Diverse History in Space and Transition to Operations**
  - **90 Satellites and 36 Launches for National, DOD, and Civilian Sponsors**

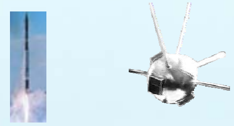
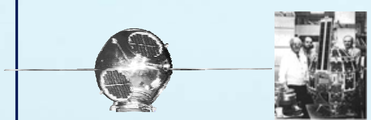
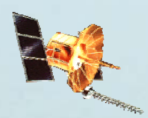
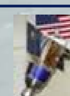




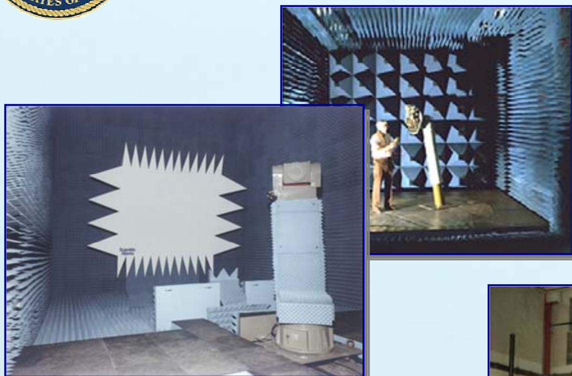


Consistent Record of R&D Prototyping Which Transitions to Industry & Operations

NRL History: *Making Space Tactically Relevant to the Joint Community*

1956	**Blossom Point** “Mini-Track”		1st Satellite Ground Tracking Station, Transitioned to NAVSPASUR
1958	**Vanguard Satellite & Rocket**		Nation’s Oldest Orbiting Satellite. Rocket Transitioned to New NASA & Created Foundation for Delta Rockets.
1960	**GRAB / Poppy**		1st U.S. Reconnaissance Satellite & First National ELINT Operational System
1974	**Timation/NTS**		1st Global Positioning System (NAVSTAR GPS) Satellite/Time From Space
1983	**FLTSATCOM** (Early NRL Payloads–Op Sys. for Navy-Not by NRL)		Navy Satellite Systems for Tactical Users (FLTSAT 1 launched 1978). MUOS is Next Generation System in Development for First IOC in ~2010.
1987-1993	**TRAP/TRE**		Global Tactical Broadcast System Lead to TRAP/TRE and IBS
1994	**Clementine**		Multiple Components Developed With Industry and Flown for First Time: Frangibolts, Common Pressure Vessel Battery, etc. Rotary Award for 1st “Faster Cheaper Better” Satellite
1996	**Onboard Processor**		Largest Supplier of Tactical Direct Downlink Reporting
2002	**WindSat**		Wind Vector From Space Transitioned to NPOESS
2004	**TacSat-1**		First ORS TacSat Experiment Completed May 2004 within 1 year (Awaiting Launch). Led to TacSat Series and Broader ORS Efforts.

NRL's Integration, Test, & Operations Capability



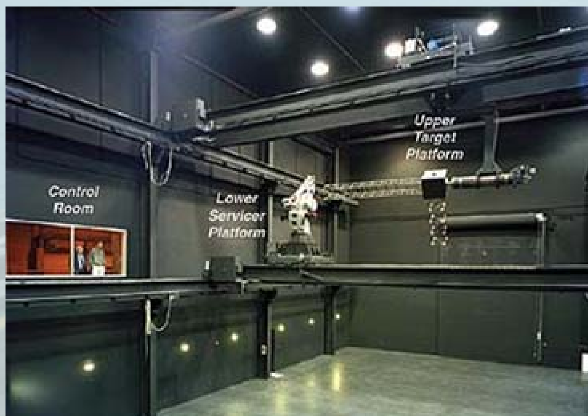
EMI/EMC/RF Ranges

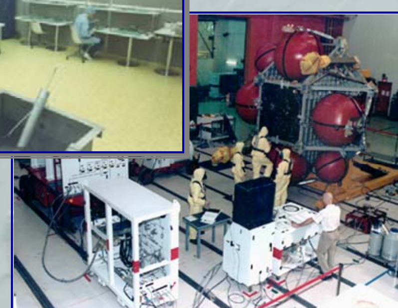
Thermal Manf.
& Application

Spin
Balance

Blossom Point Ground Station

7 DOF Robotics Lab



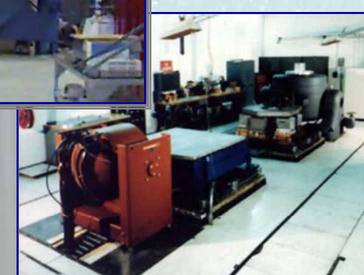


Class 100 to
100,000
Clean Rooms

Propulsion
AI&T

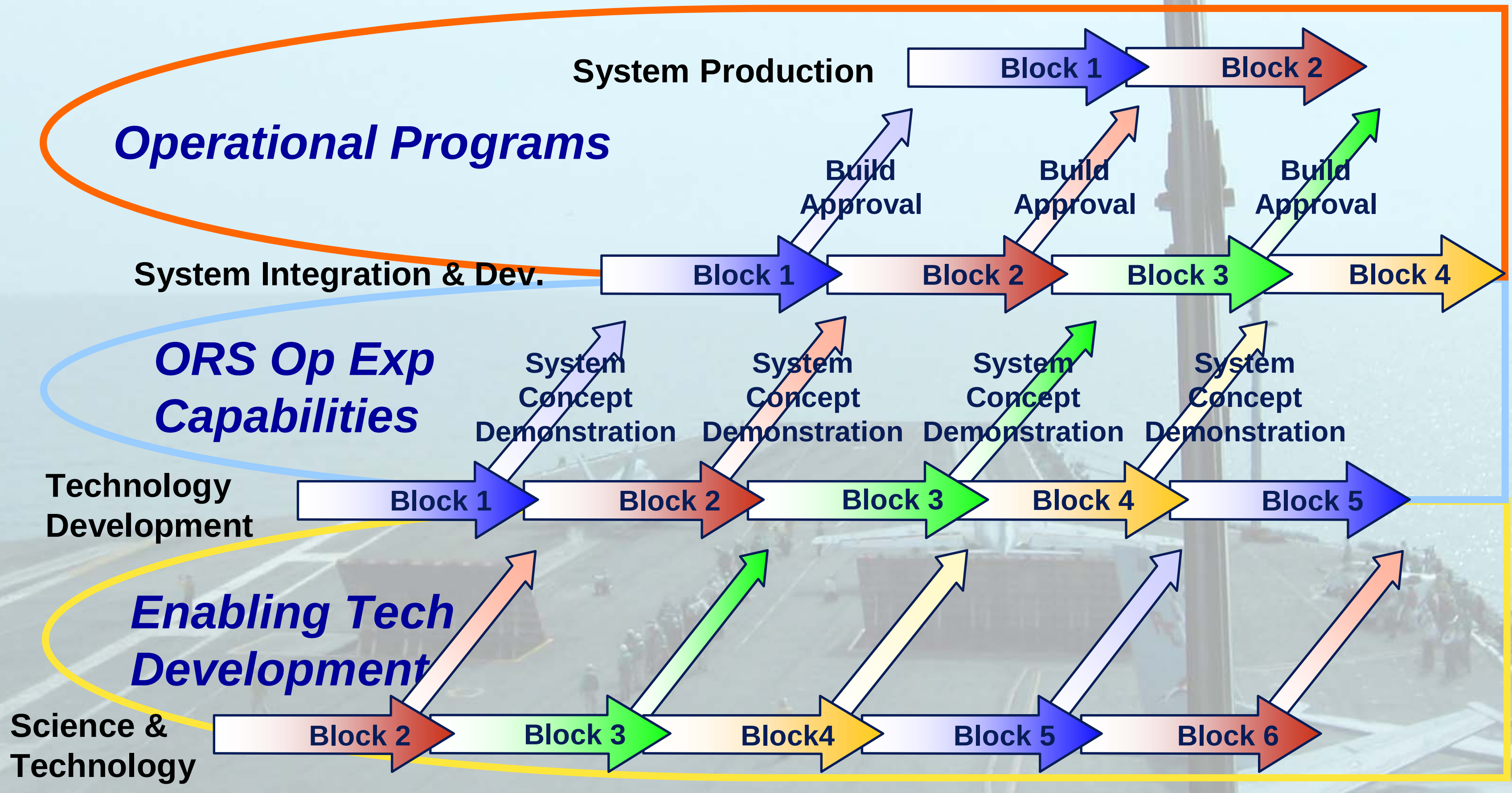
TVAC Including
15 foot Chamber

Vibration &
Acoustic

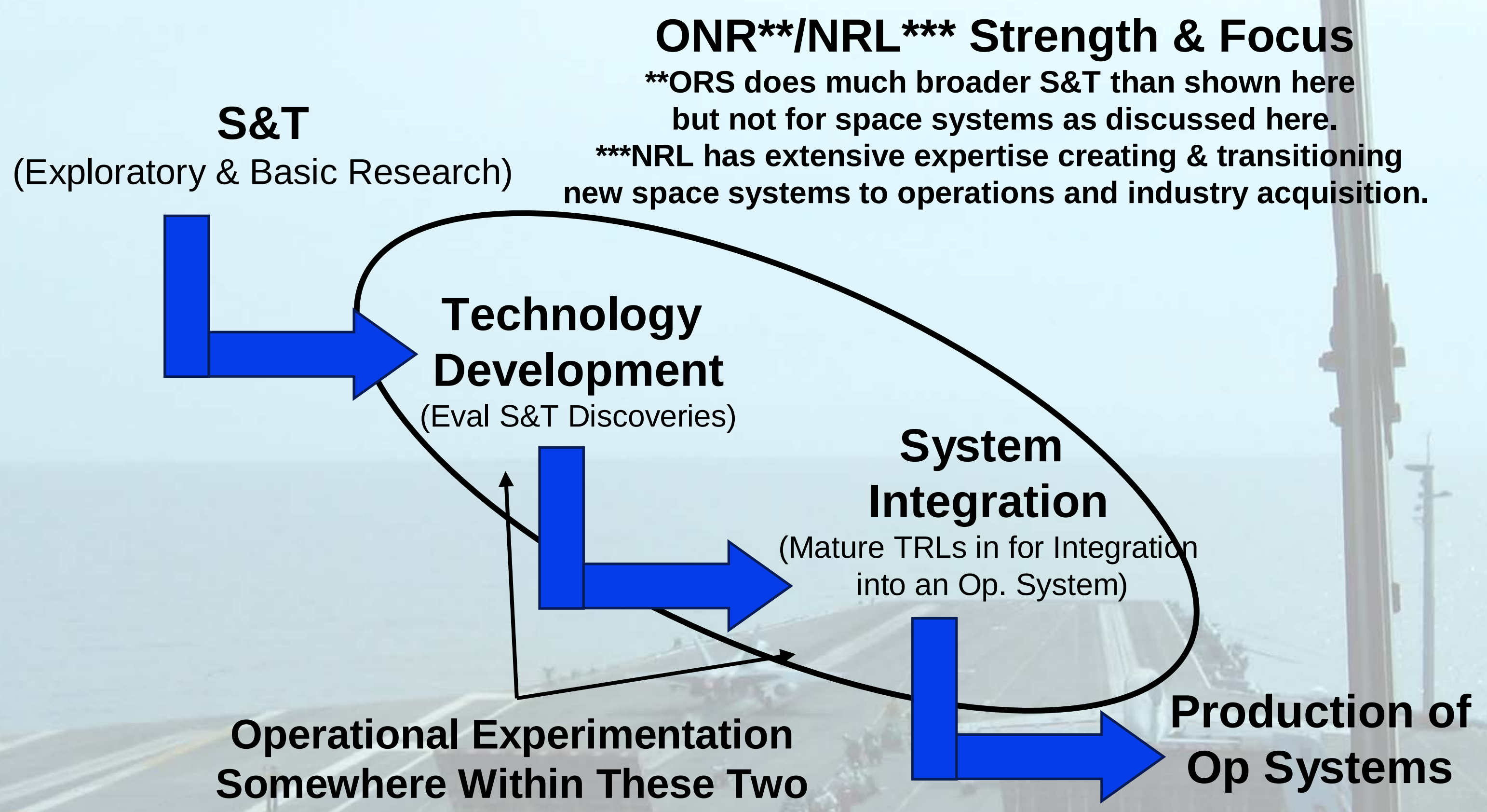


NRL has the Full Range of Facilities for Assembly, Integration, Test, and Flight Operations. Personnel are Experienced from Many Programs and Constant Use.

ORS in "Back-to-Basics" Construct is Useful for Articulating Strengths (1 of 2)



ORS in "Back-to-Basics" Construct is Useful for Articulating Strengths (2 of 2)



- **This construct is generally space systems development and acquisitions oriented so operations, for example, is not a specified component of this construct**
  - **NETWARCOM probably best fits between tech dev & system integration in this construct, but fundamentally not the best construct to explain their role**
  - **OPNAV needs/gaps assessments & rqmts guide tech dev and system integration; SPAWAR performs system integration & production for MUOS/UFO**
  - **TENCAP supports some tech development but mostly focuses on exploiting on-orbit production systems**

Draper Laboratory Role in Space System S&T

- **An independent, not-for-profit corporation dedicated to solving the nation's most challenging problems by *…***
  - **Helping our sponsors clarify their requirements and conceptualize innovative solutions to their problems**
  - **Demonstrating those solutions through the design and development of fieldable engineering prototypes**
  - **Transitioning our products and processes to industry for production and providing follow-on support**
- **An acquisition strategy that utilizes national labs as development partners & trusted agents can reduce development risk for first-of-a-kind systems**
  - **Labs support design, early prototype and initial production**
  - **Provides proven non-proprietary design**
  - **Transitions mature design to Industry for production**

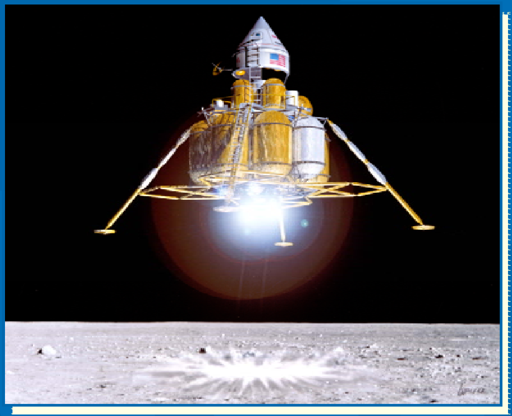
An objective engineering resource linking research to production

DRAPER LABORATORY

Draper Lab Risk Reduction Examples

Shuttle/ISS Large Space Structure Control

NASA/JSC



Assured Landing & Hazard Avoidance

JSC/LaRC/JPL

NASA Design Team for ARES Upper Stage Avionics

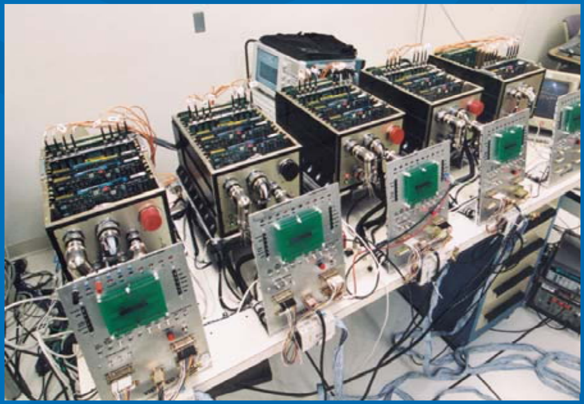
NASA/MSFC

Inertial Pseudo Star Reference Unit

34 nRad Jitter Stabilization

Inertial Stellar Compass on TacSat-2

3 kg Stellar Inertial System



X-38 Fault Tolerant Parallel Processor

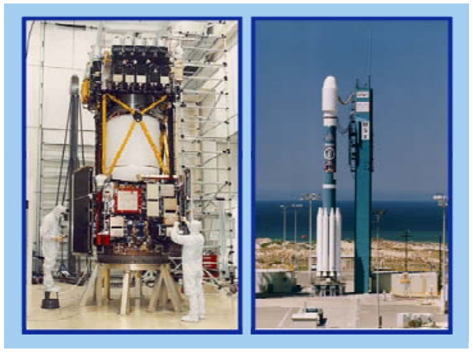
2-Fault Tolerant Flight Computer

SPACE DYNAMICS LABORATORY

A not-for-profit corporation owned by Utah State University

- Founded in 1959
- 350 employees
- 500+ successful missions
- 200,000+ ft^2 of state-of-the-art facilities
- DoD designated UARC with the following core competencies:

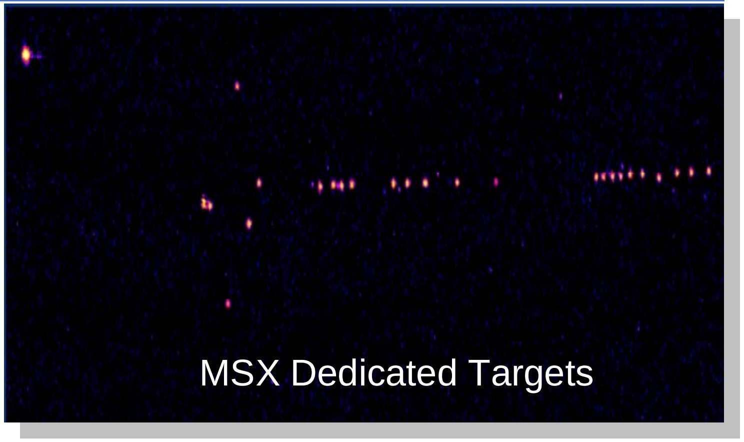
1. Electro-optical sensor systems research and development
   - Innovative sensor components and systems
   - Cryo-systems, thermal design, development, and handling
   - Data processing, handling, and analysis
   - Sensor calibration, characterization, test and evaluation
2. Ground, airborne and space rated instruments and payloads development, test and evaluation, integration, validation and operations
3. Data compression/decompression and data visualization for sensor analysis, data exploitation and data fusion
4. Phenomenology measurements, modeling, and simulation
5. Sensor modeling and simulation
6. Small/micro satellite sensor systems and components.

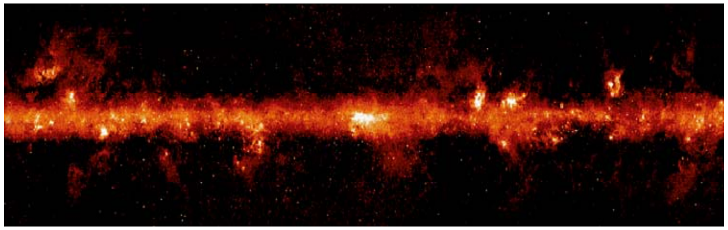


SDL: Provider of Space Technologies

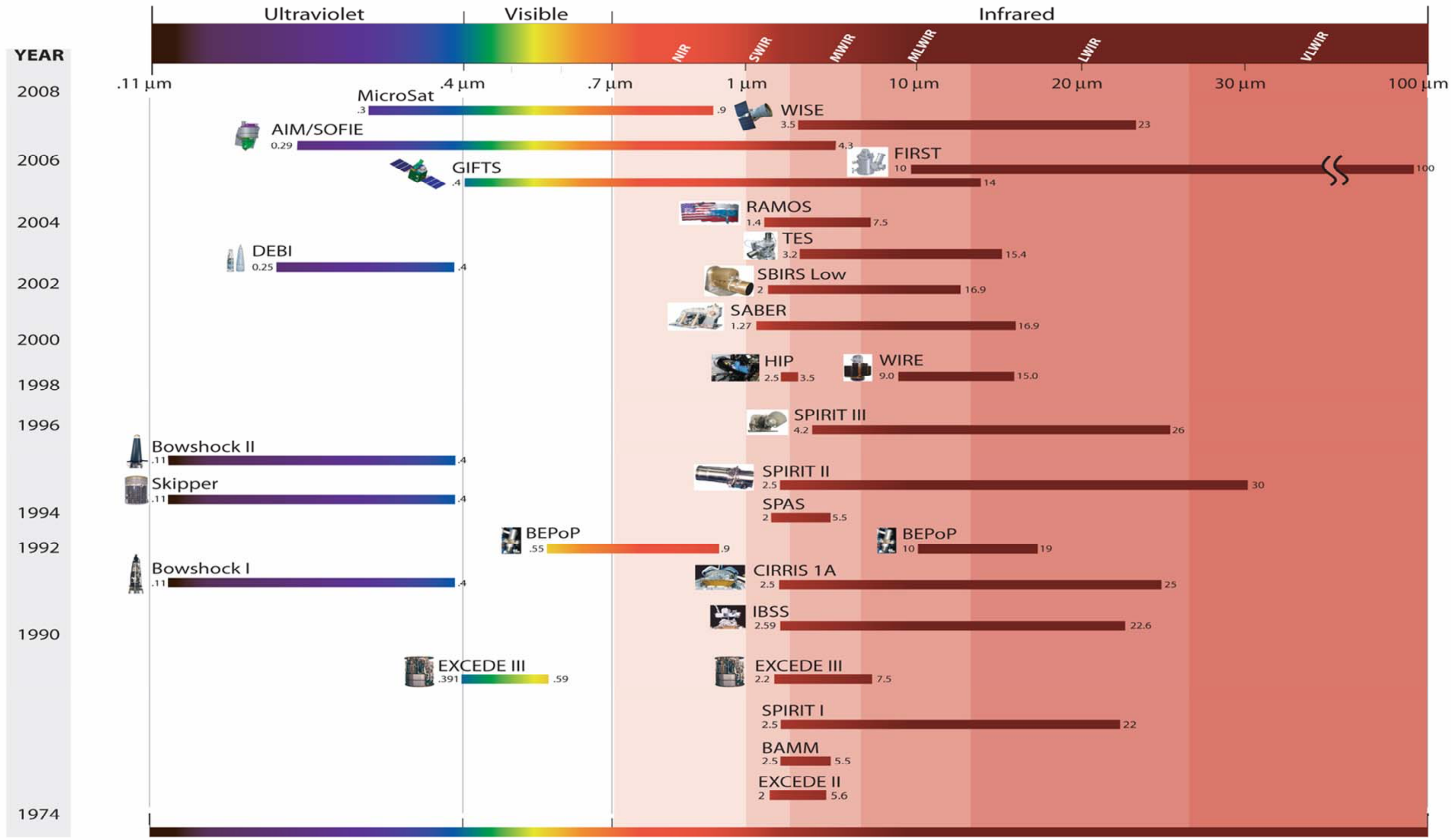
Space Dynamics LABORATORY
Utah State University Research Foundation

- Extensive sensor systems experience
  - Design, development, and prototyping
  - Performance assessments
  - Modeling and simulation
- Expertise, equipment, and facilities to calibrate and characterize electro-optical sensors
  - Internationally recognized for expertise in calibrating complex sensor systems, analyzing calibration data, and disseminating calibration information
- Proven ability and flexibility to work with the customer in addressing real world challenges
- Technology transfer to Government and Industry
- Opportunity to help shape the future by training undergraduate through post-doc students. Industry and Government staff can advance their education while working at a UARC

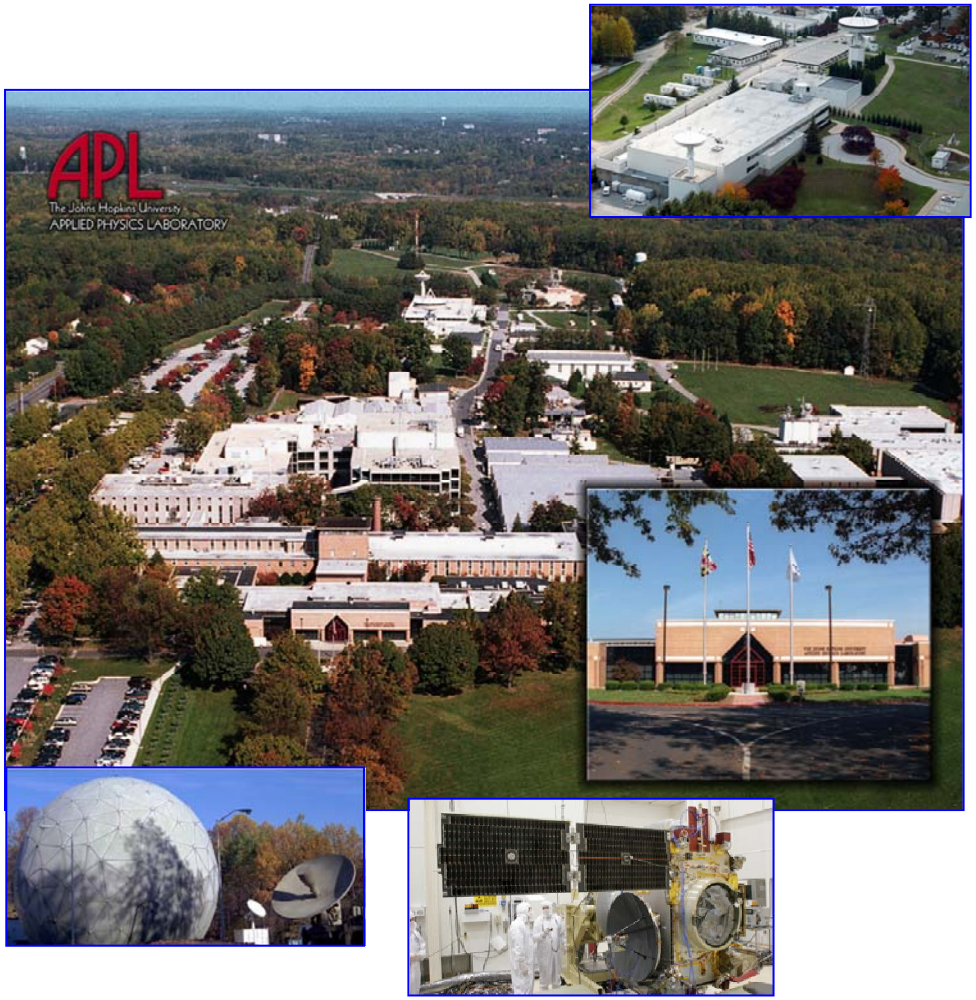




Representative SDL Sensor Programs



The Johns Hopkins University
APPLIED PHYSICS LABORATORY



- **Not-for-profit University-Affiliated Research Center**
- **Staff: 4,000+ employees (70% scientists & engineers)**
- **Business areas:**
  - **Air & Missile Defense**
  - **Biomedicine**
  - **Civilian Space**
  - **Homeland Protection**
  - **Infocentric Operations**
  - **National Security Space**
  - **Precision Engagement**
  - **Science & Technology**
  - **Strategic Systems**
  - **Undersea Warfare**
  - **Warfare Analysis**

APL Space -- in the news

SPACE NEWS
Nov 13, 2006

DMSP satellite

U.S. Air Force's DMSP Launched By a Delta 4

The U.S. Air Force successfully launched a military weather satellite Nov. 4 from Vandenberg Air Force Base, Calif., aboard a Boeing Delta 4 rocket. The Defense Meteorological Satellite Program (DMSP) F-17 satellite, built by Lockheed Martin Corp., is the second satellite in Block 5D-3 series of upgraded platforms featuring more computing and battery power than previous models, Lockheed Martin said in a Nov. 4 press release.

"We have a healthy satellite on orbit that will carry out its vital mission of supporting our warfighters," Michael O'Hara, Lockheed Martin DMSP program director, said in a prepared statement. The Air Force typically maintains two DMSP satellites in near-polar orbit to collect meteorological, oceanographic and other data on a global scale in support of U.S. military planning and operations.

Now in its fourth decade, the DMSP program is managed by the Air Force Space and Missile Systems Center at Los Angeles Air Force Base. Three DMSP 5D-3 satellites are in storage at Lockheed Martin awaiting launch.

The launch was the seventh for the Delta 4 since its introduction in November 2002, and the third in the medium-class configuration, Boeing Integrated Defense Systems of St. Louis said in a Nov. 4 press release.

Dec 2006

SPACE NEWS
Oct 30, 2006

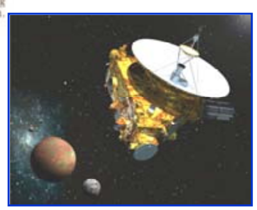
NEWS BRIEFS

NASA's STEREO Solar Observation Mission Begins

A pair of solar observation satellites was successfully launched into orbit Oct. 26 by a Boeing-built Delta 2 rocket. The nearly identical Solar Terrestrial Relations Observatory (STEREO) will generate the first near real-time, 3-D images of the Sun.

STEREO's main mission is to image coronal mass ejections, immense eruptions from the Sun that spew high-energy particles that can pose a radiation hazard for astronauts and satellites, as well as interfere with power and communications systems on Earth.

Engineers at the Johns Hopkins University's Applied Physics Laboratory built the STEREO spacecraft for NASA, and will oversee the $550 million mission.



BEST OF WHAT'S NEW

SPACE NEWS
Nov 13, 2006

NEWS BRIEFS

AFRL Picks 3 to Do Space Surveillance Sensor Designs

The U.S. Air Force Research Laboratory (AFRL) recently awarded three contracts worth $1 million each for initial design work on a prototype space-based surveillance sensor that could keep tabs on objects in geostationary orbit, according to an AFRL spokesman.

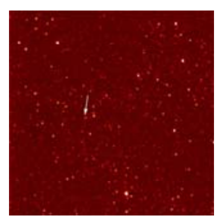
Johns Hopkins Applied Physics Laboratory, Ball Aerospace and Technologies Corp., and Goodrich Aerospace won the Lightweight Electo-Optical Space Sensor contracts (LEOSS), according to Michael Kleiman, an AFRL spokesman.

Follow-on work could include a flight demonstration, according to a Johns Hopkins news release issued on Nov. 8, but Kleiman said in a Nov. 9 e-mail that the Air Force is still defining the extent of the work that could follow those three contracts.

SPACEFLIGHT NOW The leading source for online space news

Nov 28, 2006

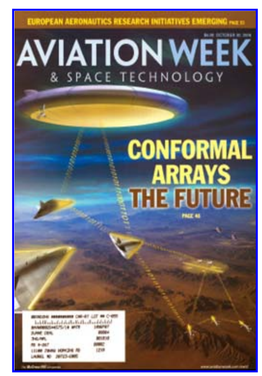
New Horizons probe makes its first Pluto sighting



A white arrow marks Pluto in this New Horizons Long Range Reconnaissance Imager (LORRI) picture. Seen at a distance of about 4.2 billion kilometers (2.6 billion miles) from the spacecraft, Pluto is little more than a faint point of light among a dense field of stars. Credit: NASA/Johns Hopkins University Applied Physics Laboratory/Southwest Research Institute

APL-generated image from the Advanced High Resolution Radiometer (AVHRR) on the NOAA polar-orbiting satellites

AIAA
Cover story
Nov 2006



Oct 30, 2006

APL's Triple Play

Applied Physics Lab controllers reach for the Sun via the Moon, piloting third spacecraft by Venus

APL

A tradition of “Firsts” in space since 1958

1958 Satellite Navigation System

1961 Nuclear-powered spacecraft

1963 Gravity gradient stabilization

1967 Color picture of the full Earth

1972 Drag-compensated satellite

1975 Pulsed plasma thrusters

1982 Autonomous satellite navigation with GPS

1984 Artificial comet

1986 Intercept of a thrusting target in space

1988 Autonomous target acquisition and track

1996 Hyperspectral Imager in space (MSX)

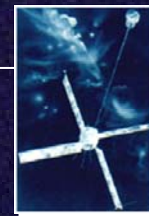
1996 Invention of Polymer Battery

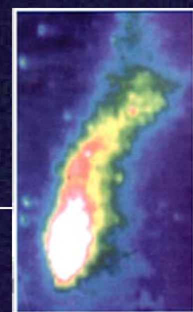
2001 Landing on an asteroid (NEAR)

2003 Re-Configurable Self-Repairing Processor (on FEDSAT)

2004 Orbital Mercury exploration mission launched (MESSENGER)

2006 Mission to Pluto (New Horizons)



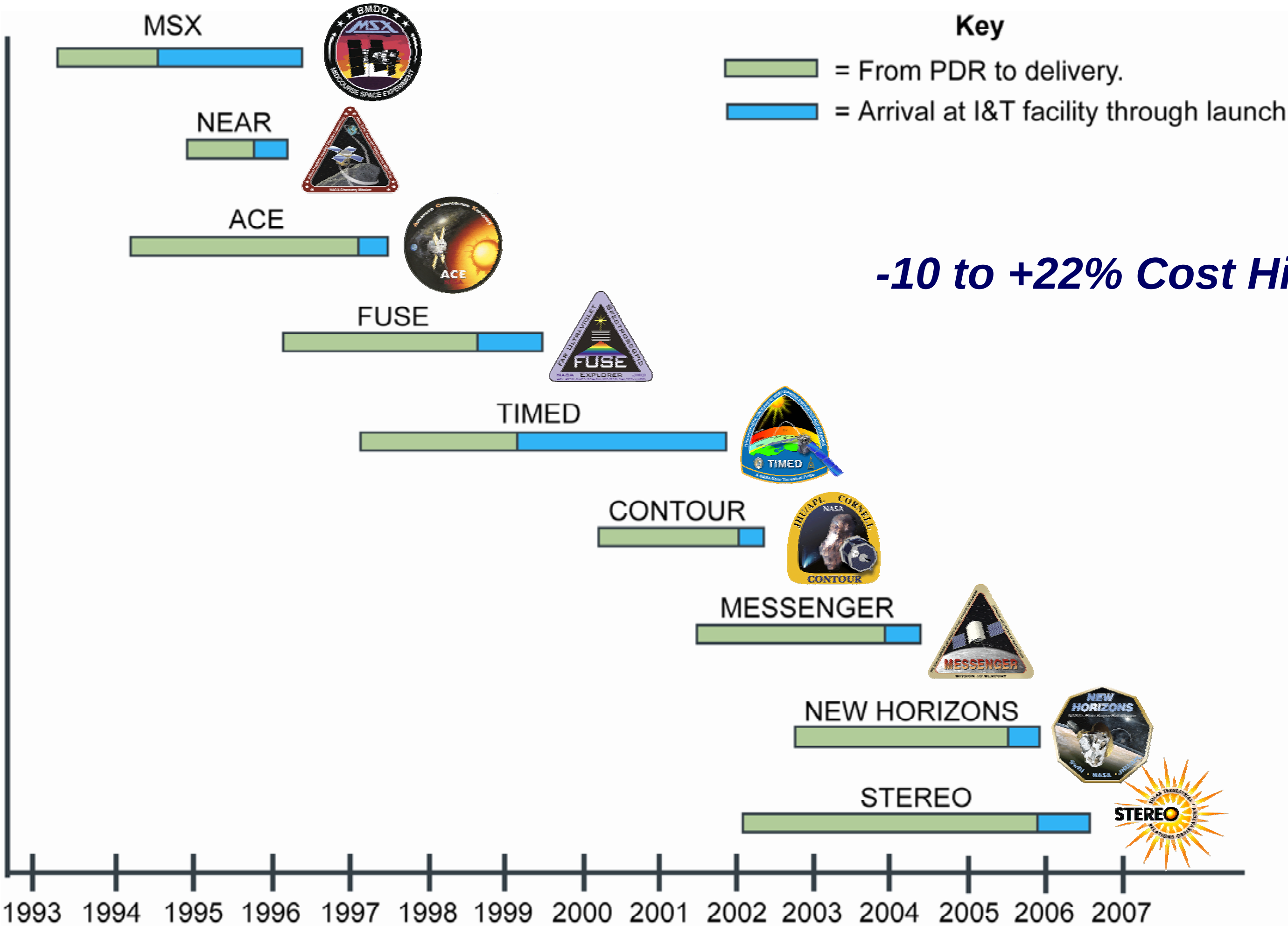



APL's "Space Portfolio" … *developing new space capabilities*

- **APL -- 64 spacecraft, 150+ payloads since 1958**
- **Produce operational prototypes**
  - **e.g., TRANSIT to Midcourse Space Experiment (MSX)**
- **National Security Space roles**
  - **Technical Direction Agent**
    - **Studies and analyses, technology advice**
    - **Data analyses, decision aids**
  - **Advanced Technology Development**
    - **S&T components**
    - **Sensors**
  - **Implement Space Missions**
    - **Mission Design**
    - **Build spacecraft, integration, T&E, operations**
    - **Applications**

Unique bridge between NASA space and DoD/IC needs

APL spacecraft – 1996-2006



-10 to +22% Cost History

Ground segment experience – APL actively operates 6 spacecraft

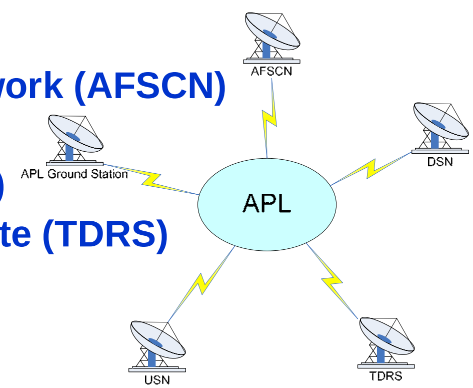
MSX

TIMED & STEREO (x2)

MESSENGER and New Horizons

Connectivity:

- Air Force Satellite Control Network (AFSCN)
- Deep Space Network (DSN)
- Universal Space Network (USN)
- Tracking and Data Relay Satellite (TDRS)



Decades of hands-on <u>operational</u> experience

Recurring theme

If --

"Back to Basics" is the question …

Then --

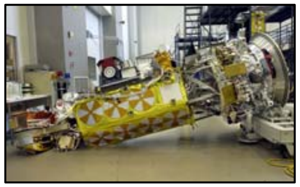
a government, industry, & lab mix
is the best answer.

9th National Security Space Policy & Architecture Symposium

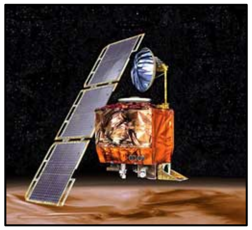
Applying S&T capabilities to the end-to-end cycle

"Ready, willing, and *quite* able"

Choose your (preventable) "disaster" …



Satellite toppling



Mars Climate Orbiter

Sago Mine

Genesis

Enron

Pipeline leak

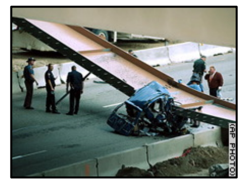
Comair 5191

USS San Francisco

Katrina

Challenger

Mars Polar Lander



Denver highway beam

Refinery fires

USS Greeneville

Tank versus road

Car versus fighter

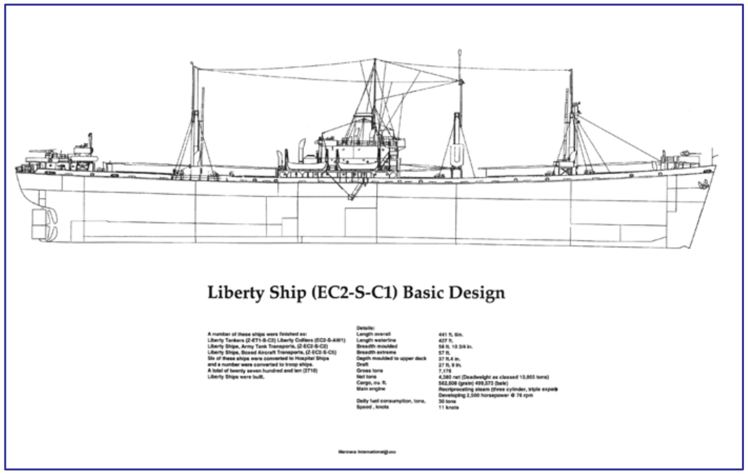
The Big Dig

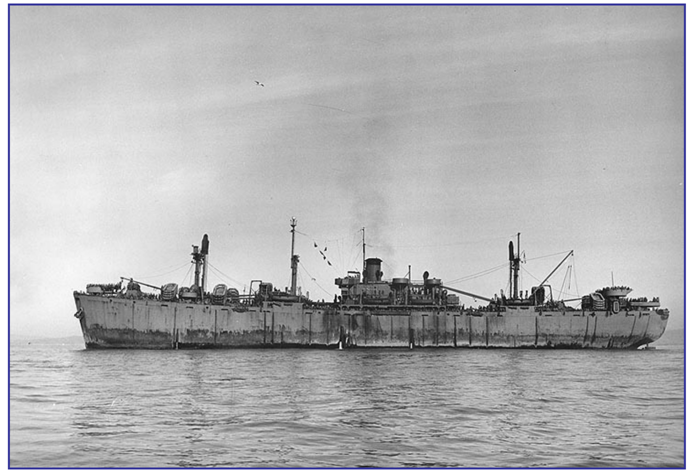
9/11

Columbia

Concorde

Developing “crack stoppers”





Per Mr. Payton, DUSecAF:

- Liberty ships’ structural failures – “crack stoppers” saved the day
- Common thread between space disasters & other disasters
- Root causes similar, identifiable – and <u>can</u> be *mitigated*
- Acquisition problems <u>are</u> disasters
  - National security capabilities absent/diminished/delayed
  - ~$12B remediation impacts other areas (= Space Pearl Harbor?)
- Need to stop those “cracks” to deliver what’s promised
  - Technical/schedule risks, cost estimates, requirements

Labs as "crackstoppers"

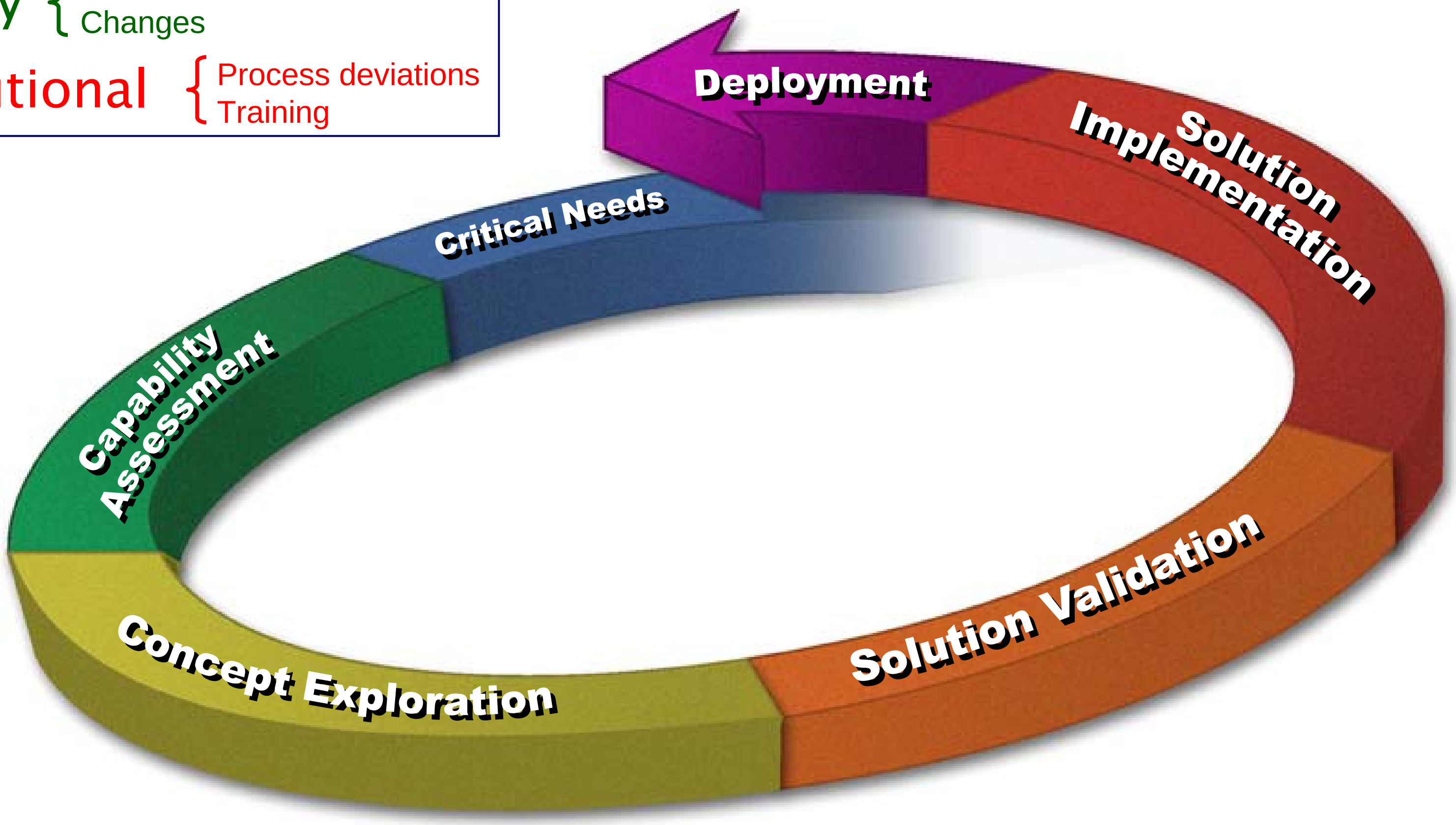
- Four-stage process
  - System Production
  - Systems Development
  - Technology Development
  - Science & Technology
- Reapportion Risk
  - Lower risk in Production
    - Use mature technology
  - Higher risk in S&T

Labs'
"Sweet spot"

Assume mission-oriented, end-to-end development …
A Systems Approach

Managing Risks:

- Program { Schedule, Cost, Scope
- Technical { Performance, Drawings
- Quality { Non-conformances, Changes
- Institutional { Process deviations, Training



Critical Needs

Defining Requirements

Capabilities Improvement Needs Definition

Managing Risks:

- Program { Schedule, Cost, Scope
- Technical { Performance, Drawings
- Quality { Non-conformances, Changes
- Institutional { Process deviations, Training

Capability Assessment

Capability Assessment

Data Collection

Mission Performance Analysis

Managing Risks:

- Program: Schedule, Cost, Scope
- Technical: Performance, Drawings
- Quality: Non-conformances, Changes
- Institutional: Process deviations, Training

Concept Exploration

Develop Enabling Science & Technology

Hypothesis, Concept Development Trade-offs, & Critical Experiments

Modeling and Simulations

Managing Risks:

- Program
  - Schedule
  - Cost
  - Scope
- Technical
  - Performance
  - Drawings
- Quality
  - Non-conformances
  - Changes
- Institutional
  - Process deviations
  - Training

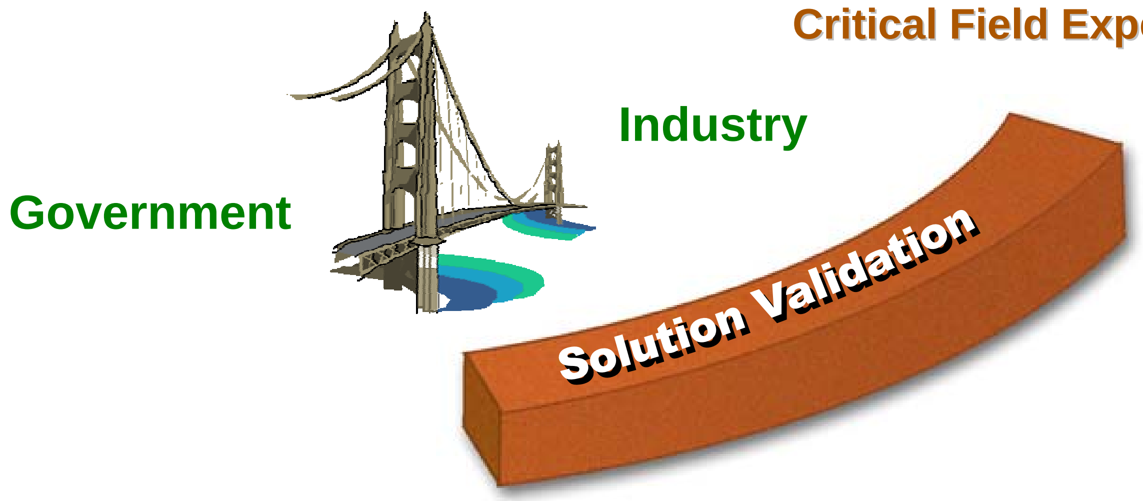
Solution Validation

Managing Risks:
- Program { Schedule, Cost, Scope
- Technical { Performance, Drawings
- Quality { Non-conformances, Changes
- Institutional { Process deviations, Training

Prototype Development

Performance Demonstration

Critical Field Experiments



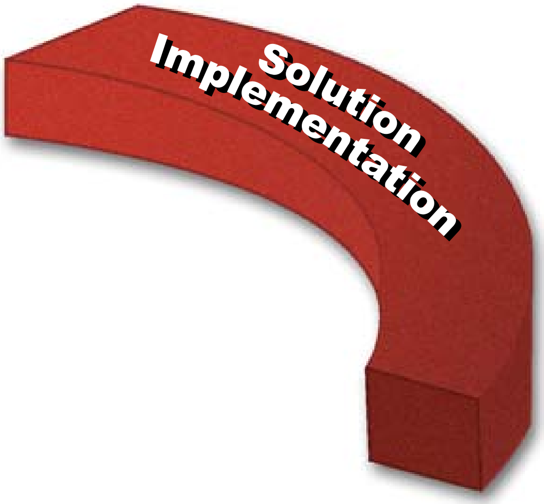
Technology Knowledge Transfer (*NLT this step*)

Solution Implementation

Product Development & Production

Test & Evaluation

Performance Verification



Managing Risks:

- Program { Schedule, Cost, Scope
- Technical { Performance, Drawings
- Quality { Non-conformances, Changes
- Institutional { Process deviations, Training

Deployment

Operational Data Collection

Lessons Learned

Managing Risks:

- Program
  - Schedule
  - Cost
  - Scope
- Technical
  - Performance
  - Drawings
- Quality
  - Non-conformances
  - Changes
- Institutional
  - Process deviations
  - Training

Assume mission-oriented, end-to-end development …
A Systems Approach

Managing Risks:
- Program { Schedule, Cost, Scope
- Technical { Performance, Drawings
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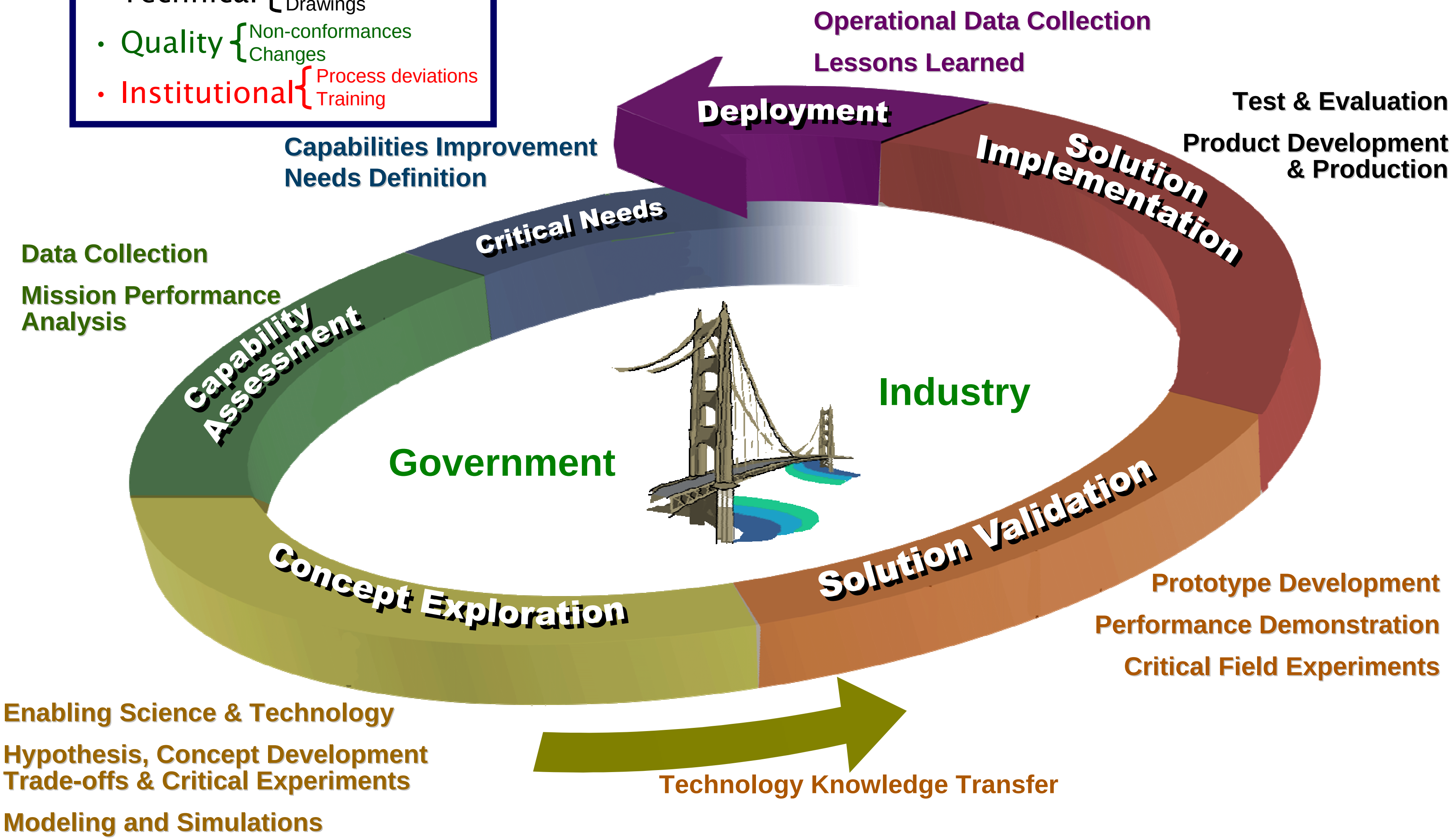
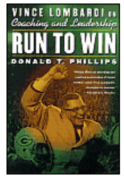
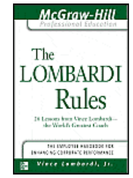


One Rx



"Focus on Fundamentals."
Vince Lombardi



Interactive Government / Industry / Lab *partnership* to:

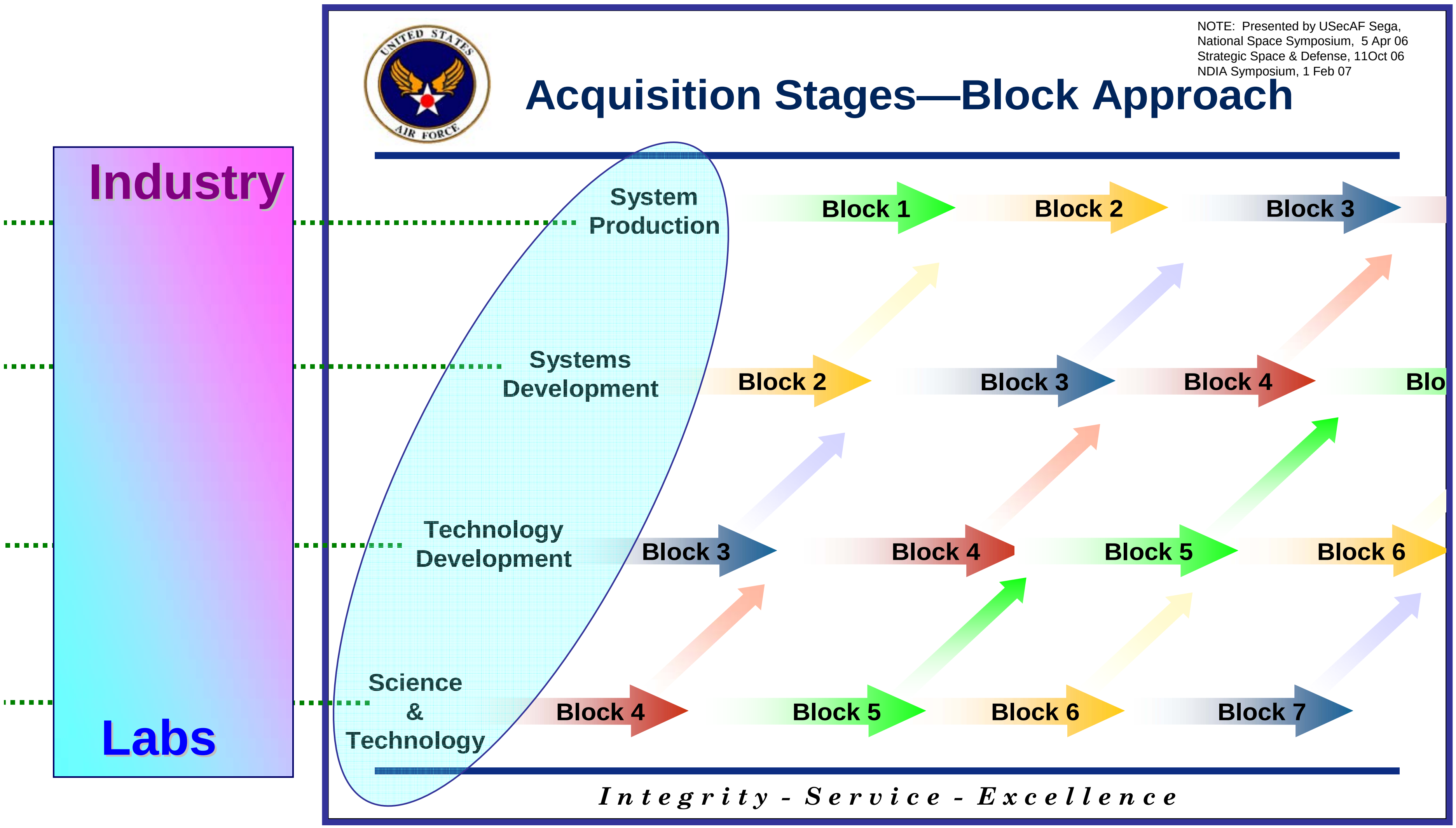
- Freeze requirements (minimize ECPs)
- Make rigid, realistic schedule start to launch (target XX months)
- Shape external environment during program (level funding)
- Small multi-expert, experienced, collocated team
- Team authority to do the missions
- Spacecraft and instruments designed to cost
- Minimize low TRL components / TRL maturation
- Get long lead items early
- Use lead engineer and method for all subsystems
- Design in reliability and redundancy
- Have R&QA engineer reporting directly to project manager
- Have single agency manager to interface with contractor

9th National Security Space Policy & Architecture Symposium

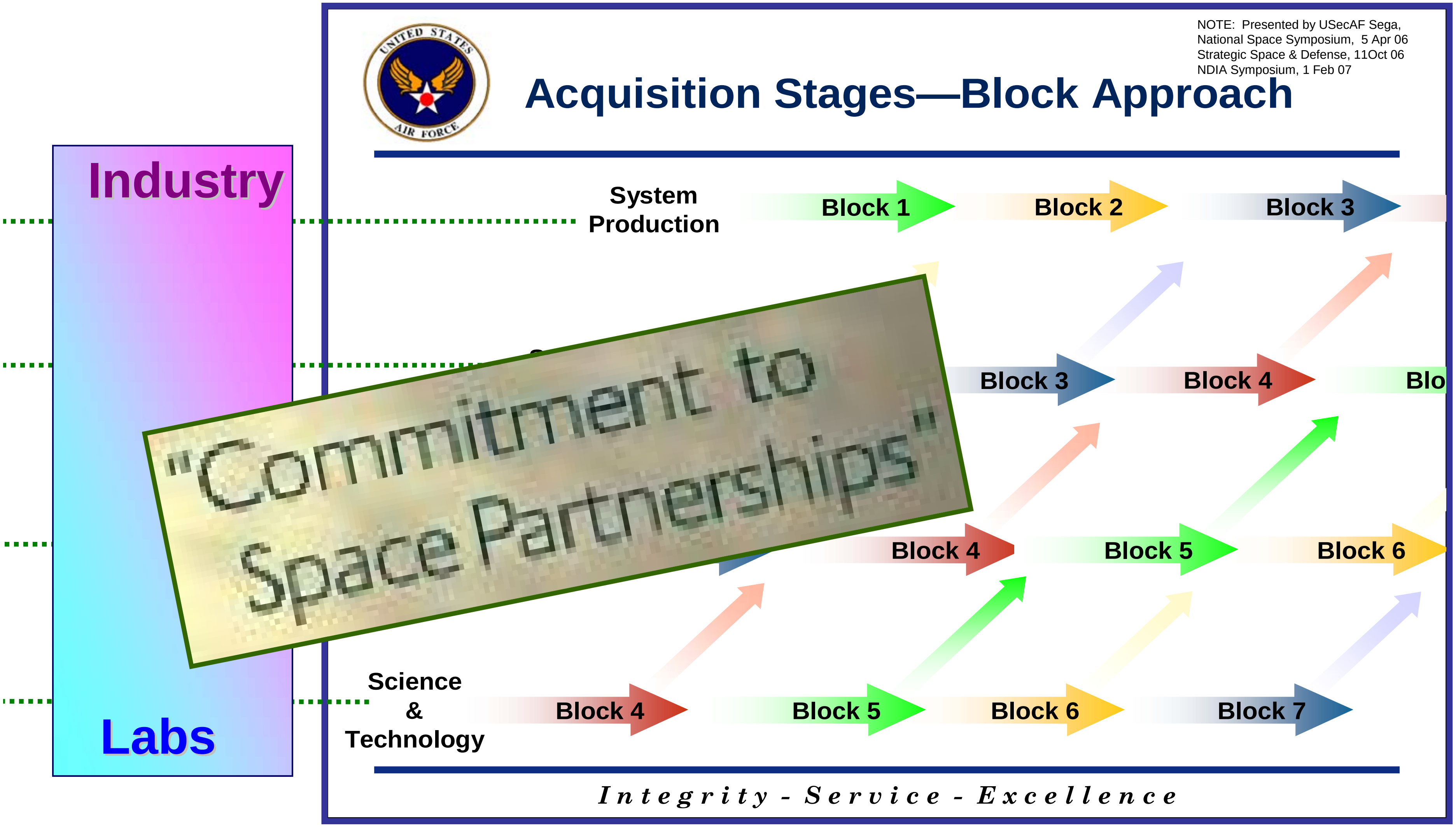
Summary

"Committing to space partnerships"

USecAF2


Industry
Labs
NOTE: Presented by USecAF Sega,
National Space Symposium, 5 Apr 06
Strategic Space & Defense, 11Oct 06
NDIA Symposium, 1 Feb 07
Acquisition Stages—Block Approach
System Production
Block 1
Block 2
Block 3
Systems Development
Block 2
Block 3
Block 4
Blo
Technology Development
Block 3
Block 4
Block 5
Block 6
Science & Technology
Block 4
Block 5
Block 6
Block 7
Integrity - Service - Excellence

USecAF2



Industry
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Acquisition Stages—Block Approach
System Production
Block 1
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Block 4
Blo
Block 4
Block 5
Block 6
Science & Technology
Block 4
Block 5
Block 6
Block 7
"Commitment to Space Partnerships"
Integrity - Service - Excellence

Theme

If --

“Back to Basics” is the question …

Then --

a government, industry, & lab mix
is the best answer.

"Commitment to
Space Partnerships"

NATIONAL DEFENSE INDUSTRIAL ASSOCIATION
STRENGTH THROUGH INDUSTRY & TECHNOLOGY

9th National Security Space Policy & Architecture Symposium

Thanks.

2007 National Security Space Policy
and
Architecture Symposium
“Commitment to Space Partnerships”

Panel on “Managing the Space Enterprise”

Gary Federici

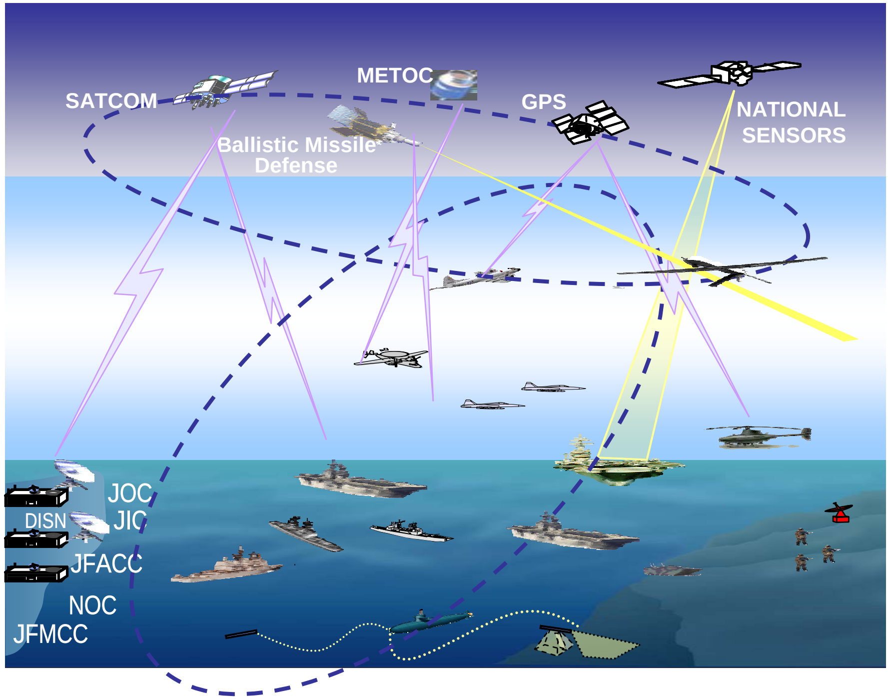
Deputy Assistant Secretary of the Navy (C4I/Space)

Navy Space Vision

…Integrating space capabilities throughout the naval forces
…Shaping joint deliberations to assure combat effectiveness

Strategic Objectives

- **Drive system design**
- **Tailor processing and distribution architectures**
- **Integrate into platforms and operations**
- **Train and educate**



Achieving the Vision

Assessment	Requirements	S&T/R&D	Acquisition	Operations
Evaluate capability needs & priorities	Determine, articulate & defend DoN rqmts	Develop / transition technology	Acquire / translate & defend rqmts	Integrate space into fleet / operate systems

Navy Space Team

Assessment | **Requirements** | **S&T/R&D** | **Acquisition** | **Operations**

Assessment

N2 NCDP & IC
N6 NCDP
N8 NCDP

DC, PP&O
DC, P&R
Dir, Int
Dir, C4

Requirements

N2 Intel Process
N6 JCIDS
N8 JCIDS

DC, PP&O
DC, P&R
Dir, Int
Dir, C4

S&T/R&D

ONR:
Space INP
NRL:
ORS/TacSat
Base S&T
N6:
TENCAP

CG, MCWL

Acquisition

PEO SS:
MUOS
PEO C4I:
User Equip
SSFA:
Navy NRO reps

Dir, C4
(User Equip)

Operations

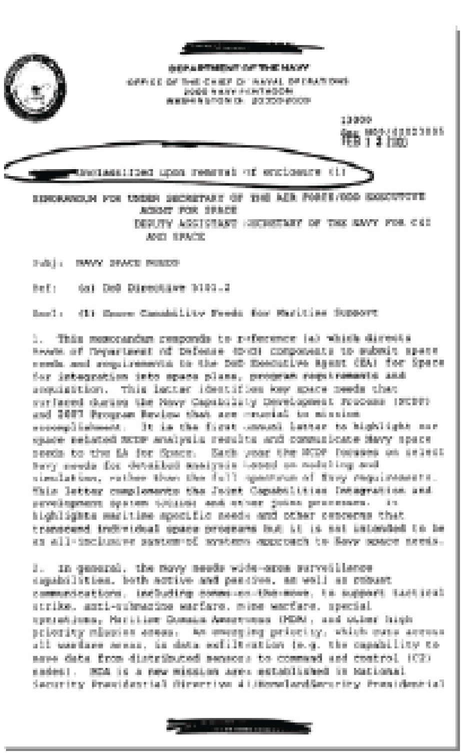
NNWC:
- Space Campaign
- NIOSC
- Fleet Needs
- NAVSOC

Operating Forces – users of space based capabilities

User Feedback

N6 is CNO's Space Lead ***DC, PP&O is CMC Space Lead***

Navy Needs Memo



[redacted]

DEPARTMENT OF THE NAVY
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
2000 NAVY PENTAGON
WASHINGTON DC 20350-2000

[redacted] Unclassified upon removal of enclosure (1)

MEMORANDUM FOR UNDER SECRETARY OF THE AIR FORCE/DOD EXECUTIVE AGENT FOR SPACE
DEPUTY ASSISTANT SECRETARY OF THE NAVY FOR C4I AND SPACE

Subj: NAVY SPACE NEEDS

Ref: (a) DoD Directive 5101.2

Encl: (1) Space Capability Needs for Maritime Support

[redacted]

Prioritized List

1. SATCOM – robust architecture
2. PNT – sync space/terrestrial segments
3. Space Control – balanced architecture for assured access
4. ISR – SIBRS for missile warning
5. Data Exfiltration
6. ISR – sensors to detect & classify contacts
7. ISR – SR for MDA
8. ORS – launch, s/c & range/C2
9. Space Situational Awareness
10. Environmental Monitoring
11. Training & Education

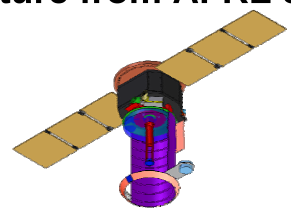
VCNO Memo, *Navy Space Needs*, Feb 13 2006 – update in work

TacSat Experiments

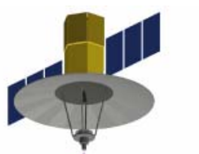
- **TacSat-1- Navy led**
  - Tactical RF Payloads & UHF Cross-Platform Link
  - Low Res Visible (70m) & IR (850m) Cameras
  - Direct Access via SIPRNET & VMOC Web Site
  - Spacecraft Completed May 04, within 1 Year
  - Launch: Falcon-1 TBD
- **TacSat-2 – AF led**
  - Tactical Imaging & RF Payloads
  - Tactical CDL & UHF Links
  - Navy Target Indicator Experiment secondary payload
  - Multiple Science Payloads
  - Spiral Development. Launched Dec 06.
- **TacSat-3 – AF led**
  - AF/Army Hyperspectral Primary Payload
  - Navy Small Data-X Payload for IP-Based Buoy Comms
- **TacSat-4 – Navy led**
  - Comms-on-the-move primary payload (HEO)
  - Secondary Data-X/BFSA payloads
  - Mission Jointly Selected on Oct 13, 2005

TacSat-1 at NRL

TacSat-2 / Roadrunner Picture from AFRL & MSI



TacSat-3 Concept from AFRL Received Go on 10/04



TacSat-4 Concept from NRL Received Go on 10/05

Navy TENCAP: Tactical Exploitation of National Capabilities

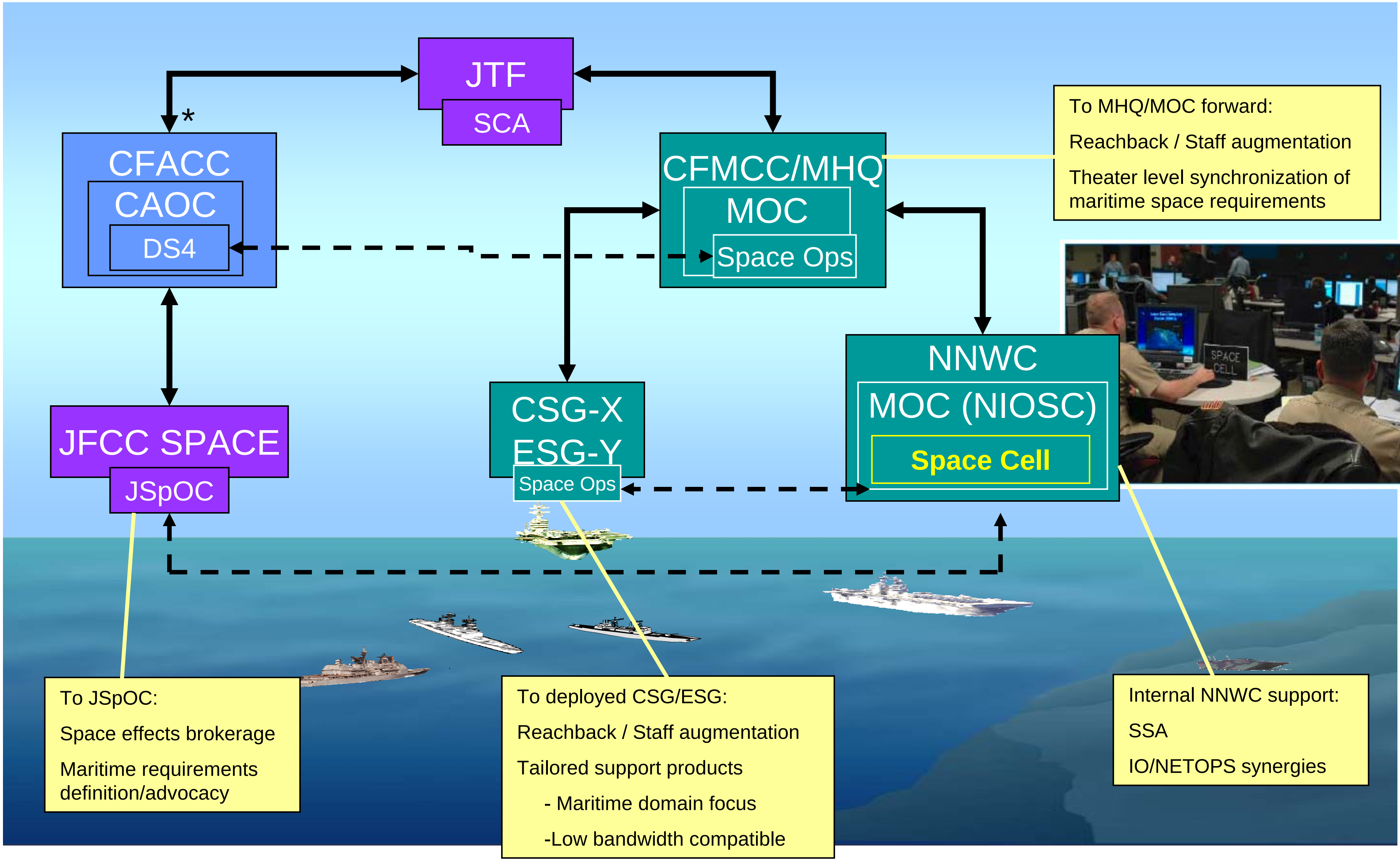
- Chartered by Congress in 1977
- MIP (Military Intelligence Program) funded/ oversight
- Navy R&D for exploiting current and future space-based ISR sensors:
  - rapid prototyping (12-24 months)
  - testing under field conditions
  - rigorous, independent assessment of results
- Executed over 110 R&D projects and transitioned over 54% into operational ISR capabilities supporting Fleet and joint forces.

Focus on solving <u>tactical</u> Fleet problems

Mobile User Objective System (MUOS)

- Four UHF GEOs, plus on-orbit spare
  - "Bent-pipe" payload
  - 16 spot beams and one earth coverage beam
  - Legacy payload compatible with UHF terminals
- Integrated ground network
  - Manages the information network
  - Controls the satellites
  - Provides access to DISN services
- New 3G CAI SA-WCDMA waveform
  - New UHF uplink & downlink filings to get contiguous 5 MHz channels
  - Provides "Comms on the Move" for 21st century mobile forces
- Three pillars for success
  - Realistic/stable requirements
  - Realistic/stable funding
  - Mature technology

NETOPS, IO & Space Center (NIOSC) - Tailored Space Products with a Maritime Focus



***Depicts current structure in CENTCOM. JTF CDR can delegate SCA lead to any component.**

DoN Space Cadre

- **WHO**

  - SECDEF directed Heads of DoD Components, "…to develop and maintain a cadre of space-qualified personnel to support their Component in space planning, programming, acquisition, and operations…"

  - Navy Space Cadre Officers come from multiple URL and RL designators and are identified by AQD, Subspecialty Code, or NOBC based on space-related education and/or experience.

  - Marine Corps believes in taking MAGTF officers and making them "Space-smart"

- **MANAGEMENT**

  - **Navy Space Cadre Advisor:** Actively manages the Total Force. Coordinates with commands, placement officers, and detailers to place qualified personnel in high-vis, technically demanding space billets. Interfaces with the NSSO, NAVPERSCOM, OPNAV N6 (Resource Sponsor), and NNWC (Space TYCOM).

  – **Deputy Commandant, Plans Policies and Operations:** responsible for development and management of the USMC space cadre

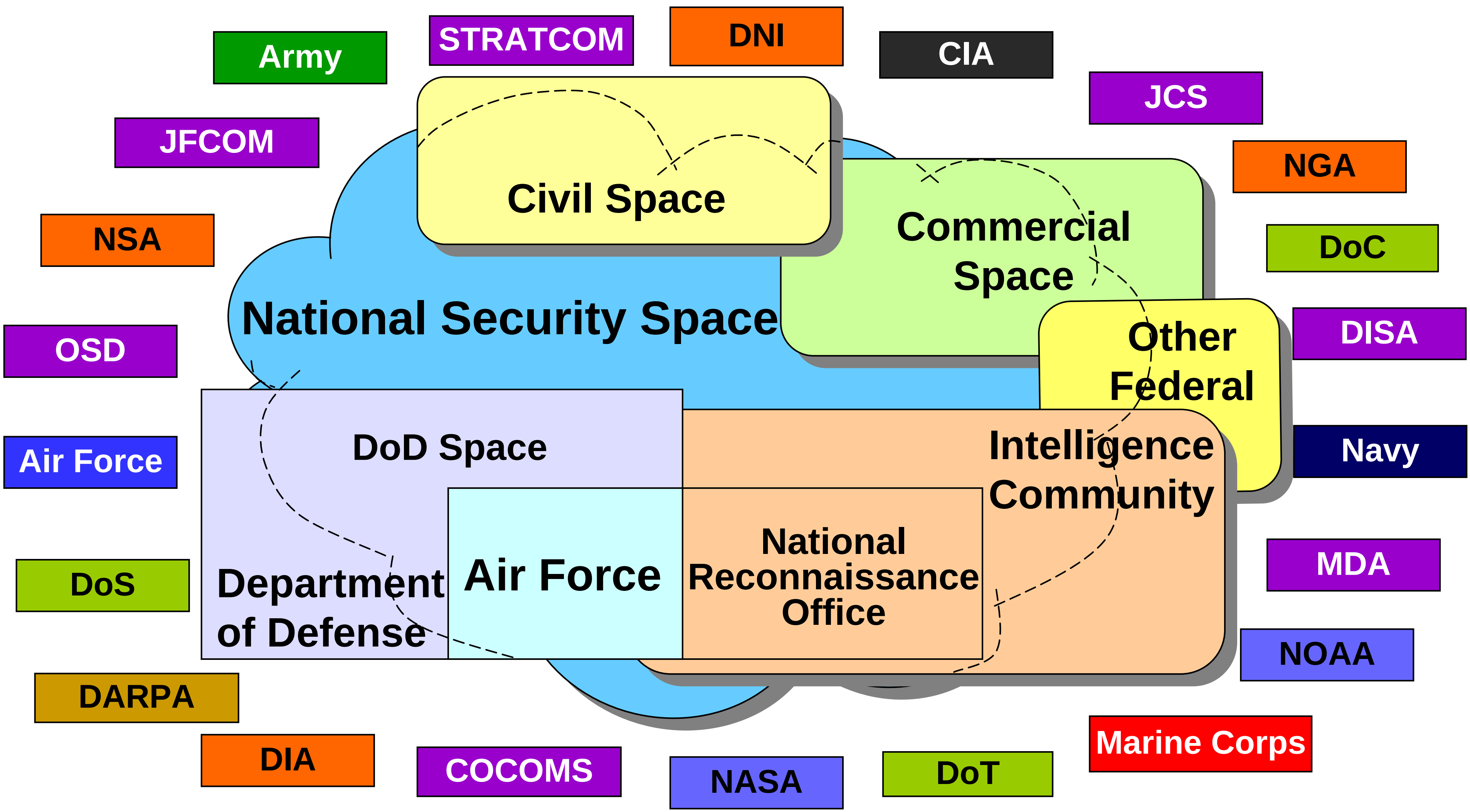
- **CURRENT DATA**

700+ Active Duty Officers	315 space-coded billets
100+ Reserve Officers	17 space-coded billets
100+ Civil Service	From multiple job series and commands
17 Space Operations Officers	8 Space Operations Officer billets
68 Space Operations Staff Officers	46 Space Operations Staff Officer billets

Summary

- Navy perspective
  - Partnerships are key – U.S. and international
  - Pragmatic focus - make space tactically relevant
- Challenges
  - Managing complexity in a fiscally constrained environment
    - Block approach good step but still need to prioritize
  - More experimentation will help reduce technical risk

National Security Space Community



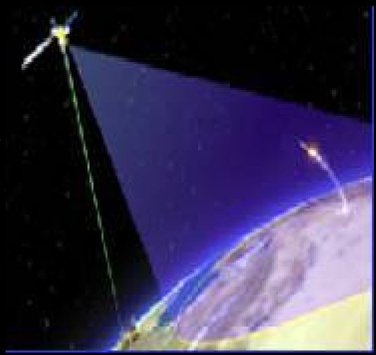
NDIA
National Security Space Policy and Architecture Symposium

Space & Missile Systems Center (SMC)

Lt Gen Michael Hamel
Commander
1 February 2007

SMC Mission

Develop, acquire, field and sustain the world's best space and missile capabilities for the joint warfighter and the nation



<u>Space Superiority</u>

Space Situation Awareness
Defensive Counter Space
Offensive Counter Space

<u>Space Support</u>

Launch Systems
Spacelift Range
Sat Control & Network

<u>Force Application</u>

ICBMs
Prompt Global Strike

<u>Space Force Enhancement</u>

Milstar/AEHF/GBS
DSCS (Comm)
GPS (Navigation)
DSP/SBIRS (Surv)
DMSP (Weather)
NUDET (Nuclear Detection)

Delivering Operationally Responsive Space Warfighting Capabilities to Preserve Peace and Win Conflicts

AF Space Organization

U.S. Air Force

DR. RON SEGA
USecAF

Acquisition Execution

GEN KEVIN CHILTON
COMMANDER

Organize, Train, Equip

AF Space Command

SMC
Space Development, Acquisition, & Sustainment

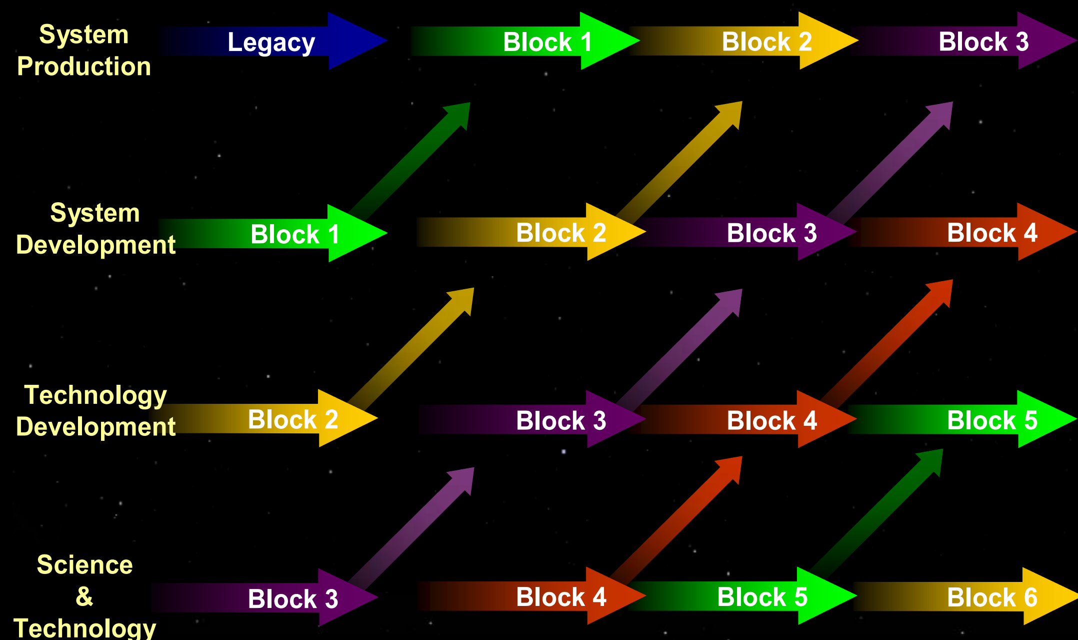
14th AF
Space Forces And Operations

20th AF
ICBM Forces

SIDC
Space Warfare Development

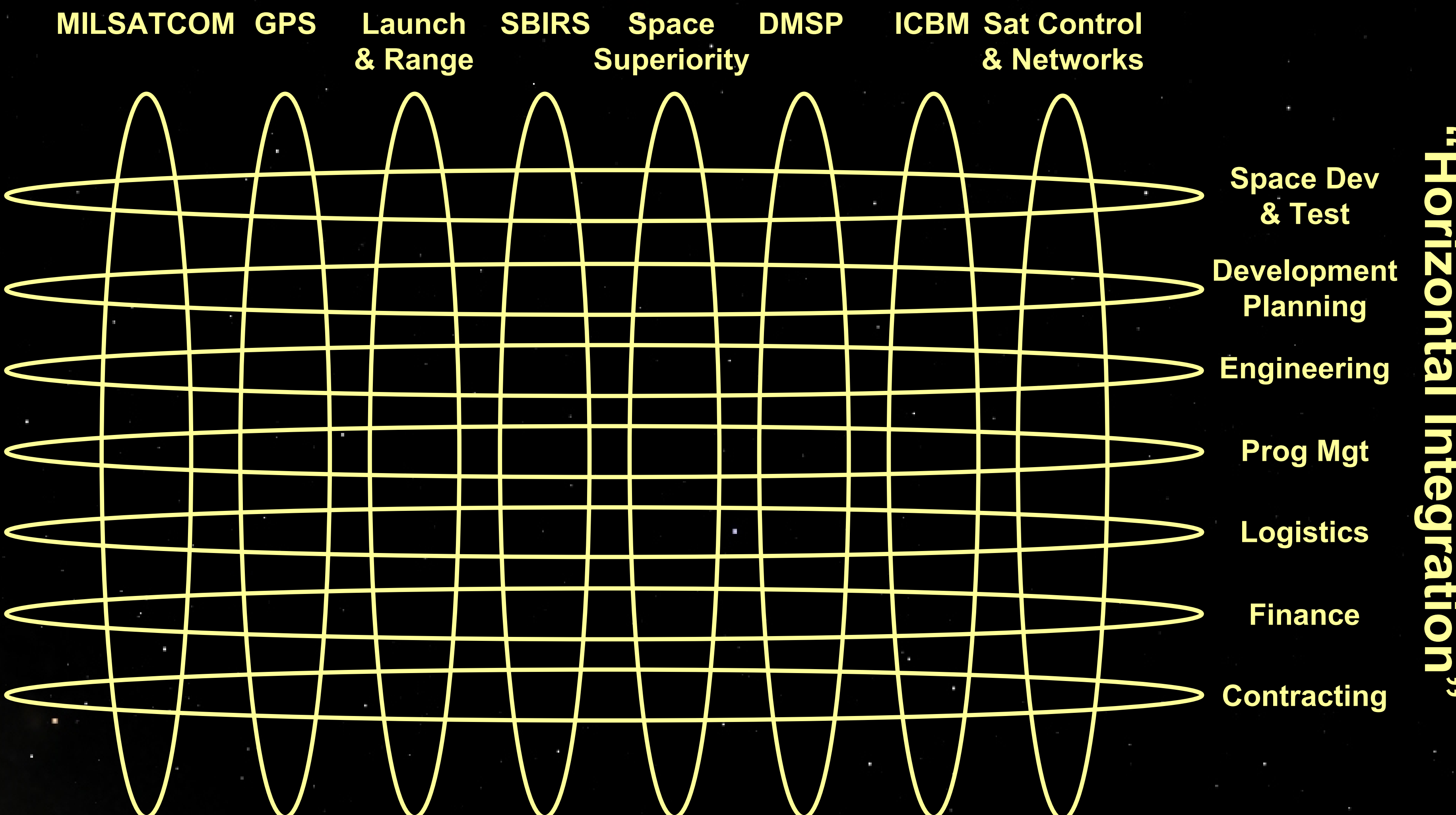
SMC "Back to Basics"

- People - Rebuild space acquisition workforce
- Processes – reestablish rigor and "best practices" in technical, program, and business management
- Partnerships – strengthen relations with operators, users, industry
- Horizontal integration – integrate across programs, enterprise, and forces – air, land, naval
- Block acquisition strategy

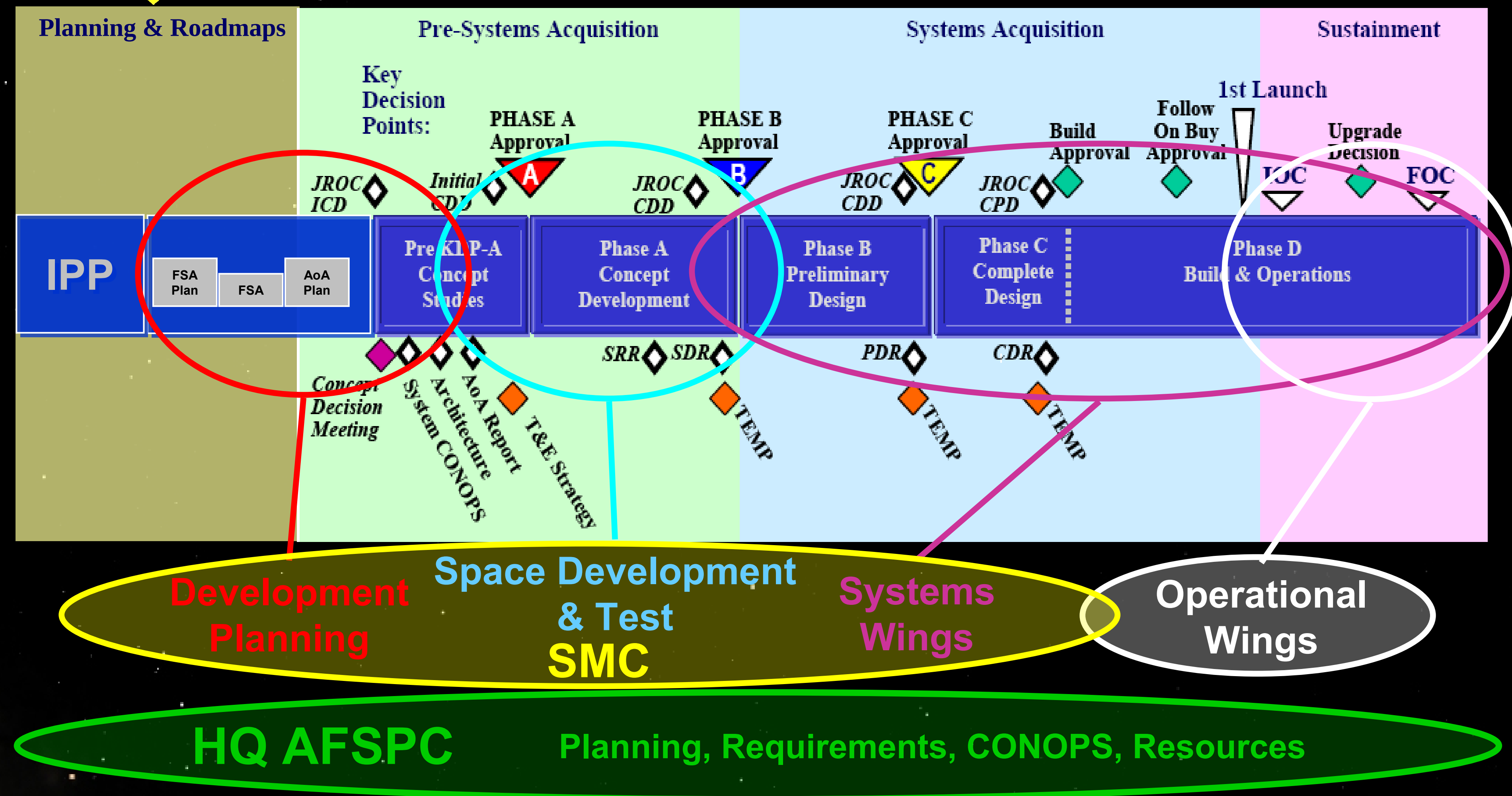


Horizontal Integration

"Vertically Integrated" SPO's



AFSPC Cradle-to-Grave Life-Cycle Management



A “Full-Service” MAJCOM

Needs → Concepts → Systems → Combat Effects

SMC Accomplishments/Way Ahead

- 100% Launch and Mission Success
  - 49 launches in a row
- Getting Programs on Track
  - SBIRS, GPS, WGS, AEHF, SBSS, FAB-T
- Defining Next Generation Programs
  - TSAT, Space Superiority, PGS
- “Delivering on Commitments” in 2007
  - WGS, GPS IIF/OCS, AEHF, SBIRS, EELV/ULA

Providing the Edge to our Nation’s Warfighters and Allies from the High Frontier

NDU Spacepower Theory Project Update

National Defense Industrial Association

2007 National Security Space Policy & Architecture Symposium

2 February 2007

Colonel Chuck Lutes, USAF
Senior Military Fellow
Project Director

Colonel Mike Bell, USA
Senior Military Fellow

Dr. Pete Hays
Visiting Fellow

Lt Col "Coyote" Smith, USAF
Visiting Fellow

Project Genesis, TOR, and Study Design

- **2005 QDR**
- **Feb 06 OSD Letter with TOR to NDU**
- **Study Design**
  - ***Yearlong effort: due Jun 07***
  - ***Seminars, Workshops, Conferences***
  - ***Product: Two Books***
    - ***Volume I: Concise Spacepower Theory***
    - ***Volume II: Comprehensive Spacepower Theory***

Seminars During Summer 2006

- Dennis Wingo*: Innovative Commercial Approaches to Space*
- Klaus Heiss: Strategic Importance of the Moon
- Joanne Gabrynowicz: *Space Law and Spacepower*
- Peter Teets: *National Security Space in the 21st Century*
- Roger Launius: *Exploration, Leadership, and Spacepower*
- Jon Sumida: *Mahan on Spacepower*
- Colin Gray: *Strategy and Spacepower Theory*
- Scott Pace: *Thoughts on Spacepower*
- Alex Roland: *Strategy, Spaceflight, and Spacepower*
- Karl Mueller: *Depolarizing the Space Weaponization Debate*
- John Logsdon: *Human Spaceflight and Spacepower*
- Theresa Hitchens: *International Perspectives of Spacepower*
- Phillip Baines: *Non-offensive Defenses in Space*
- Everett Dolman: *Astropolitik: Classical Geopolitics in the Space Age*
- Hal Winton: *On the Nature of Theory*
- Michael O'Hanlon: *Hedging Strategies: Neither Star Wars nor Sanctuary*
- Hank Cooper: *Missile Defense, the Space Connection and the 21st Century*

1st Workshop: *Merchants and Guardians*

Government's Role in Regulating, Licensing and Incentivizing Space Activity

- **NDU; 31 October 2006**
- **Approximately 40-50 attendees consisting of government and non-government experts**
- **Roundtable discussion**
- **Agenda included four panels:**
  - ***Panel 1* - Space Exploration: The Case for Public and Private Ventures**
  - ***Panel 2* - Current Commercial Space Activity: Incentives and Impediments**
  - ***Panel 3* - Crafting Laws and Policy to Facilitate Space Commerce and Exploration**
  - ***Panel 4* - Government as Regulator: The Good, the Bad, and the Ugly**

2nd Workshop: *International Perspectives*

- **NDU; 4-5 December 2006**
- **Approximately 50-60 attendees with a strong international presence**
- **Roundtable discussion**
- **Agenda Included**
  - **Panel 1 - Major Space Actors**
  - **Panel 2 - Emerging Space Powers**
  - **Panel 3 - Non-State Actors**
  - **Panel 4 - Synthesis: Spacepower and the Interrelation of US, International and Non-State Actors in Space**

Spacepower Theory: Volume II

VOLUME II CHAPTERS AND AUTHORS

Foreword: Implications of Spacepower for Geopolitics and Grand Strategy

Section I: Introduction to Spacepower Theory

Chapter 1: On the Nature of Theory: **Harold R. Winton**
Chapter 2: International Relations Theory and Spacepower: **Robert L. Pfaltzgraff, Jr.**
Chapter 3: Landpower, Seapower, and Spacepower: **John M. Collins**
Chapter 4: Airpower, Cyberpower, and Spacepower: **Benjamin S. Lambeth**

Section II: Spacepower and Geopolitics

Chapter 5: Orbital Terrain and Space Physics: **Martin E.B. France & Jerry Jon Sellers**
Chapter 6: Space Law and Governance Structures: **Joanne Irene Gabrynowicz**
Chapter 7: Building on Previous Spacepower Theory: **Colin S. Gray & John B. Sheldon**

Section III: Commercial Space Perspectives

Chapter 8: History of Commercial Space Activity and Spacepower: **Henry R. Hertzfeld**
Chapter 9: Commercial Space Industry and Markets: **Joseph Fuller, Jr.**
Chapter 10: Merchants and Guardians: **Scott Pace**
Chapter 11: Innovative Approaches to Commercial Space: **Ivan Bekey**

Section IV: Civil Space Perspectives

Chapter 12: History of Civil Space Activity and Spacepower: **Roger D. Launius**
Chapter 13: Affordable and Responsive Space Systems: **Sir Martin Sweeting**
Chapter 14: Human and Robotic Exploration: **Howard E. McCurdy**
Chapter 15: Competing Visions for Exploration: **Klaus P. Heiss & Dennis R. Wingo; Robert Zubrin**

Volume II (cont.)

Requirements for Concise Spacepower Theory

- **Volume I should:**
  - Account for the structure of the field:
    - the divergent world views of each sector and
    - the dynamics of their interactions.
  - Define the boundary conditions of the theory:
    - Cis-Lunar space as opposed to all of space
    - International perceptions of spacepower and their effect on US policy
  - Ask the key, fundamental questions regarding the uses and purposes of space to extract underlying principles.
    - Question hypotheses and present conditions.
    - Test counterfactuals.
  - Construct a framework that integrates divergent points of view and takes into account potential future scenarios.

- ***Roles of Theory: Define – Construct – Explain – Connect – Anticipate***

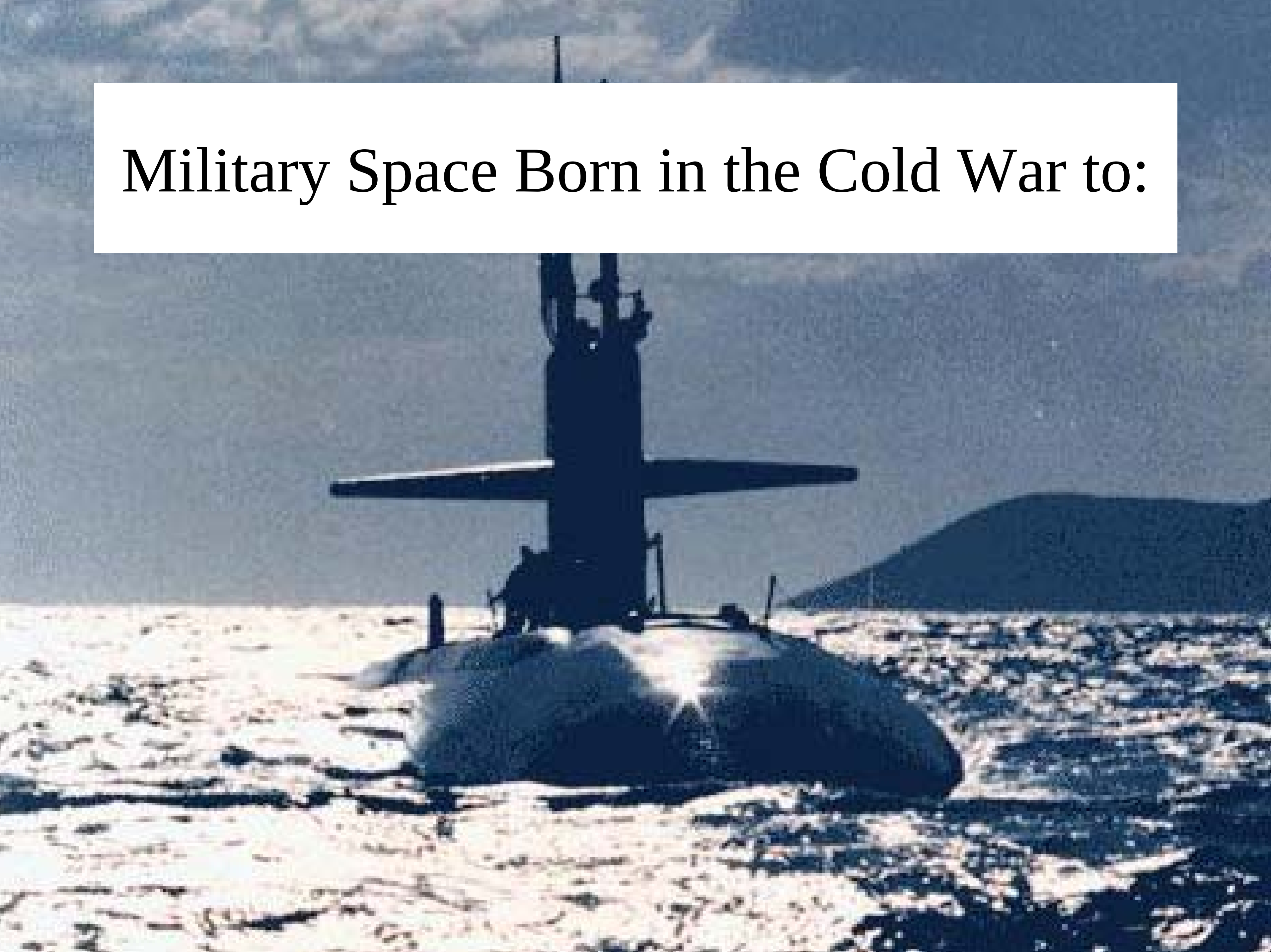
Upcoming Activities

- **NDU Capstone Symposium: *25-26 April 07***
  - Initial presentation of Volume I Spacepower Theory findings.
- **Community of Practice Website**
  - http://groups-beta.google.com/group/spacepower-theory
- **HAYSP@NDU.EDU**

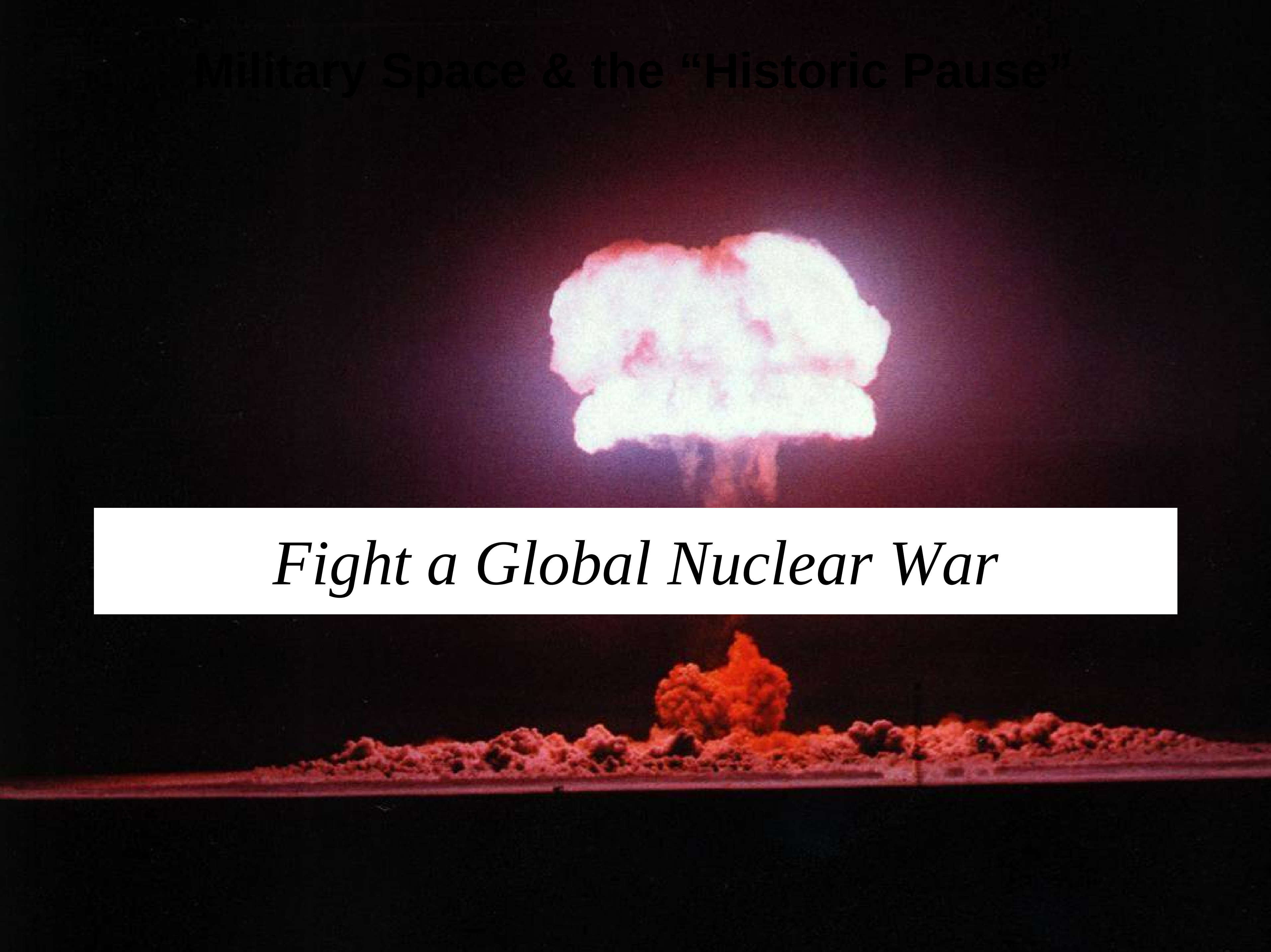

Dr. Steven Huybrechts
Director, Space
ASD(NII)
Office of the Secretary of Defense

Space is Stuck in the Cold War

Military Space Born in the Cold War to:



Track Soviet Systems In Denied Areas


Military Space & the "Historic Pause"
Fight a Global Nuclear War

Cold War Space Systems:

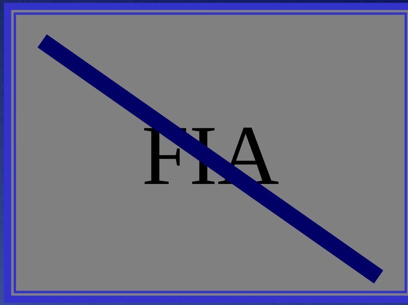
Current IMINT Systems
To: FIA

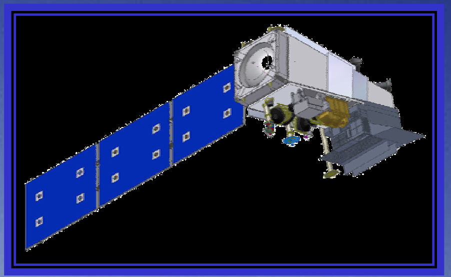
DMSP/POES
To: NPOES

GPS II
To: GPS III

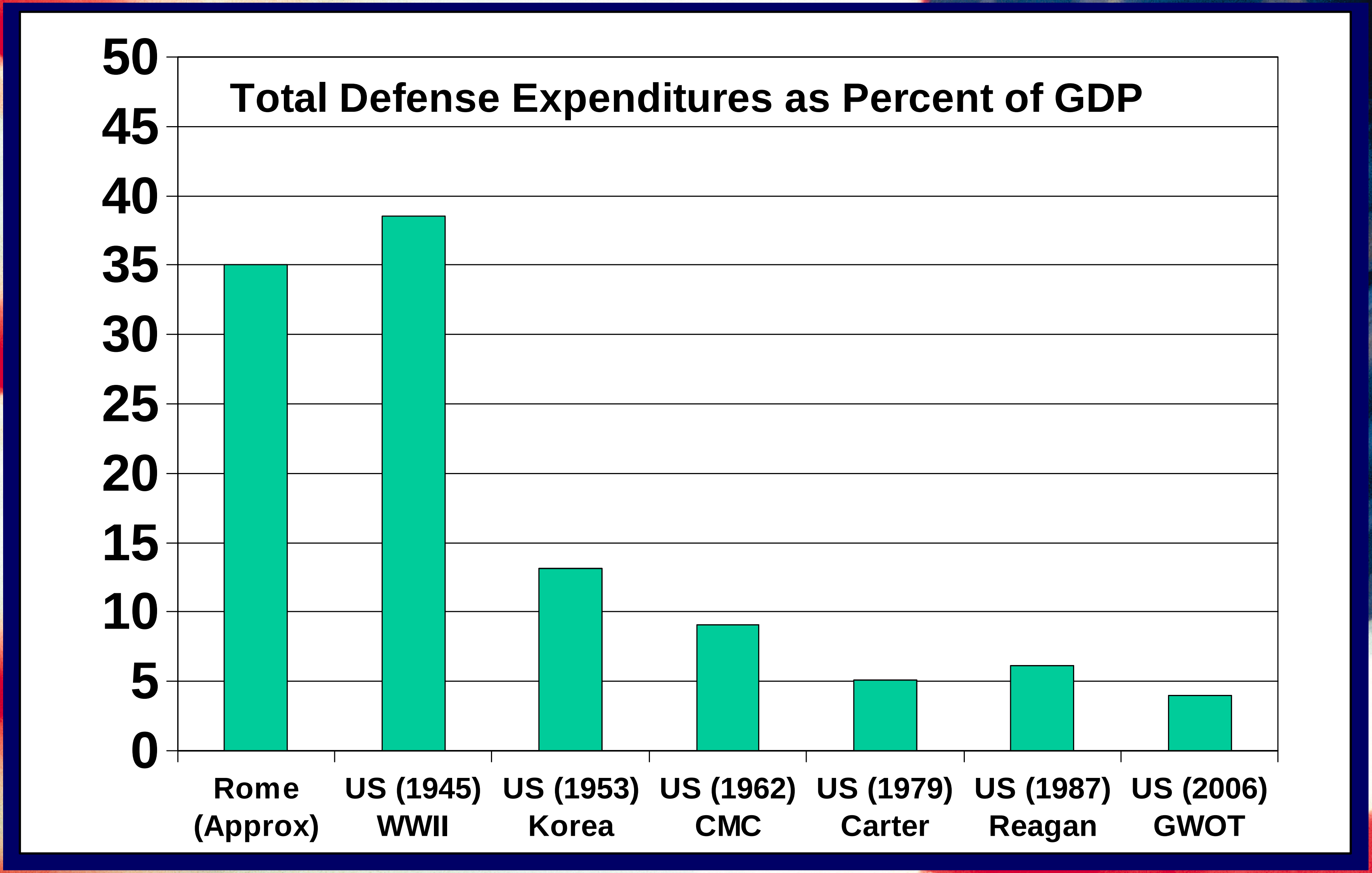
DSP
To: SBIRS

DSCS, MILSTAR, UFO
To: WGS, AEHF, TSat, MUOS





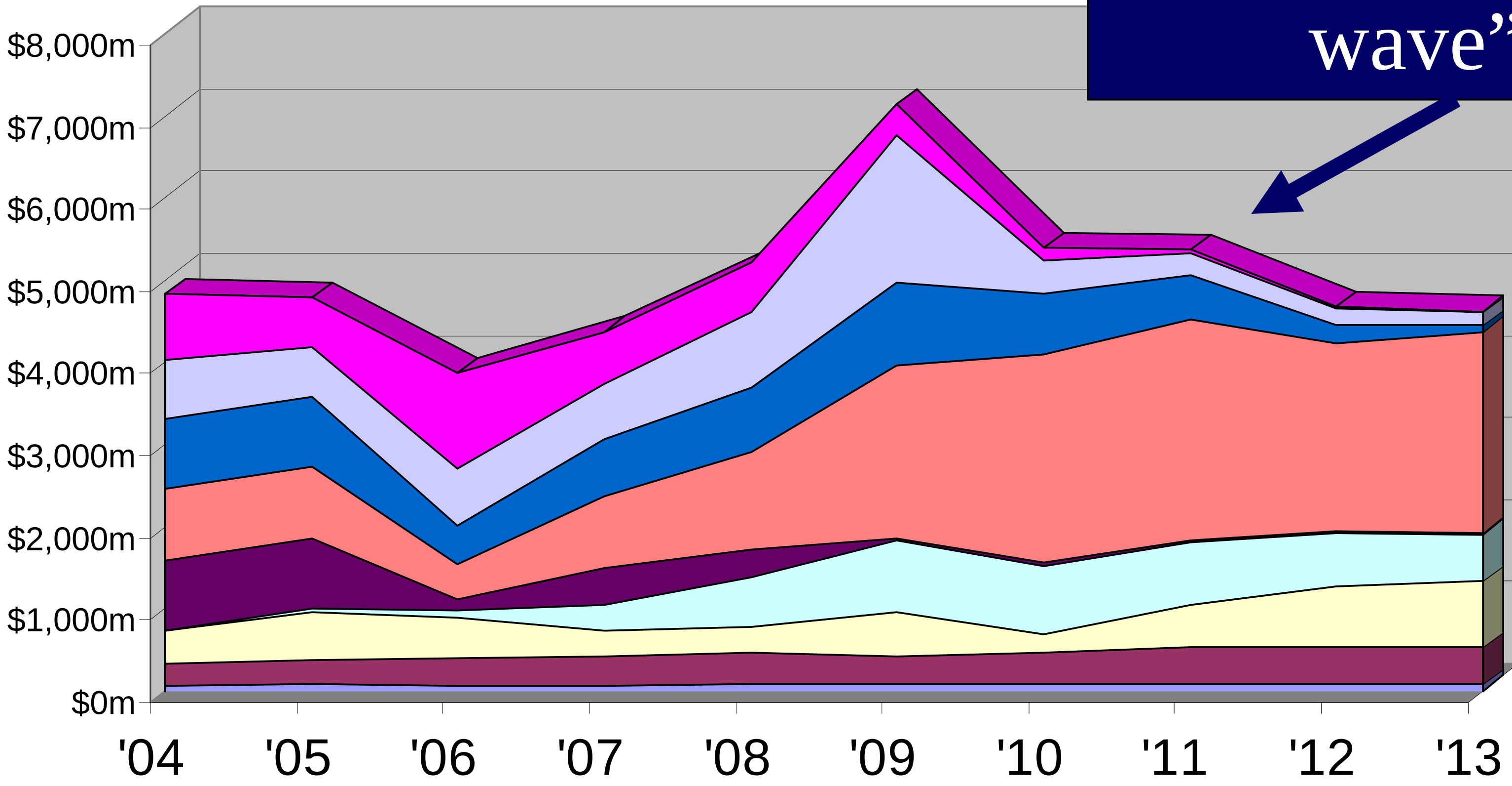

Our Architectures Need to Adapt to the New Environment
This will be Tough to Do



Total Defense Expenditures as Percent of GDP
50
45
40
35
30
25
20
15
10
5
0
Rome (Approx)
US (1945) WWII
US (1953) Korea
US (1962) CMC
US (1979) Carter
US (1987) Reagan
US (2006) GWOT

What is coming after the "bow wave"?

Major Unclassified Space Acquisitions



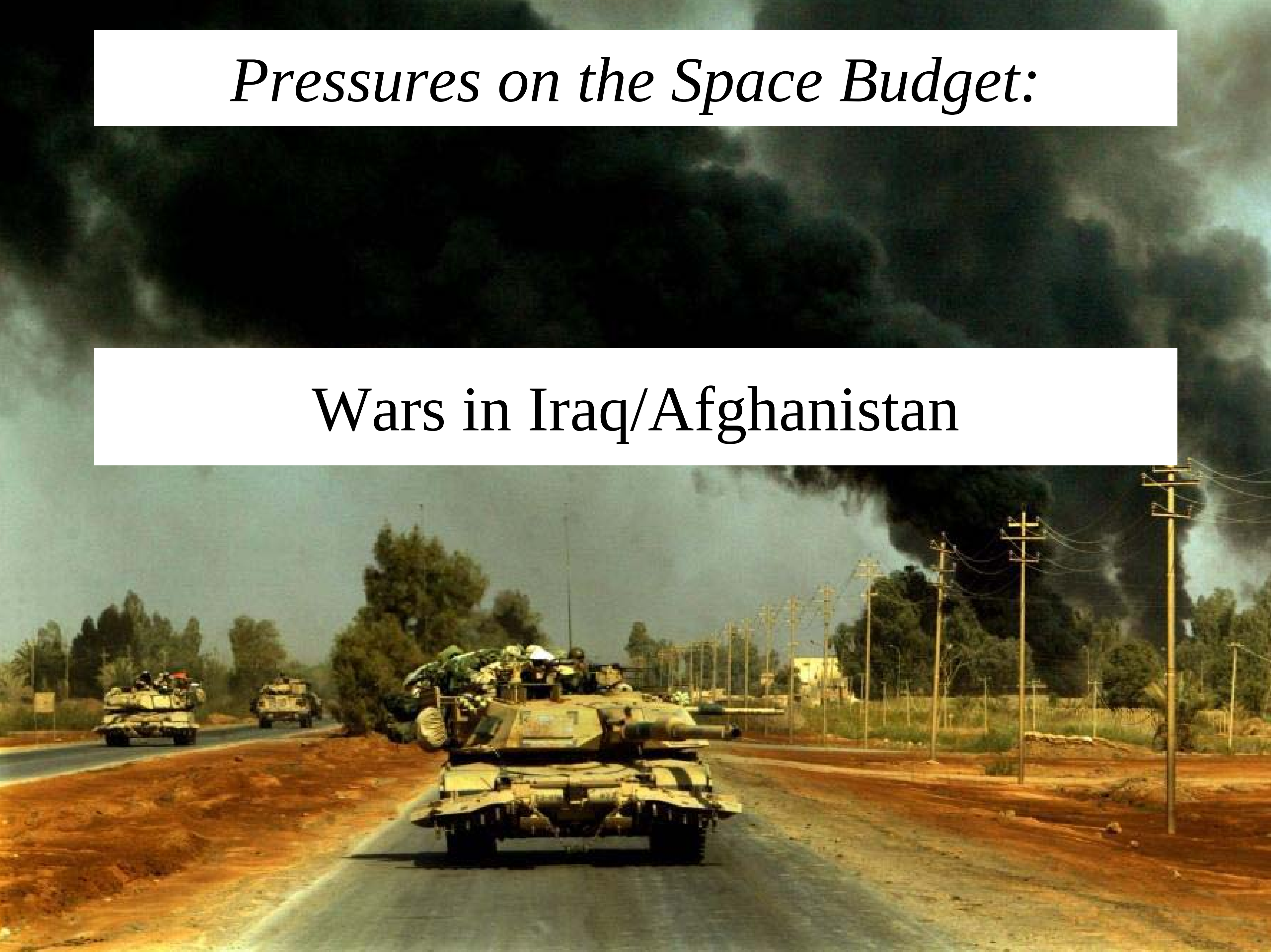
07 PB

Pressures on the Space Budget:

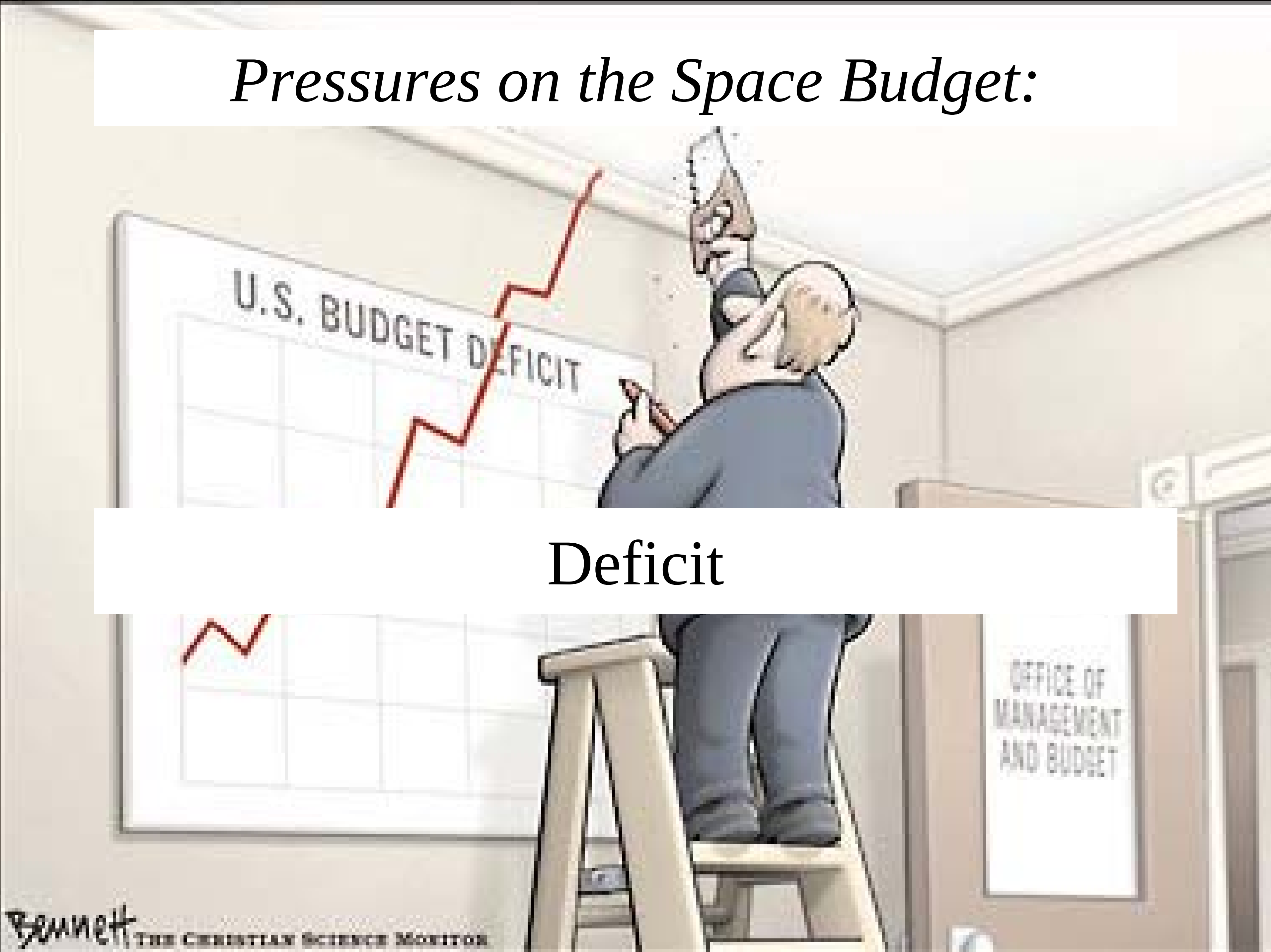
Health Care

Pressures on the Space Budget:

Wars in Iraq/Afghanistan

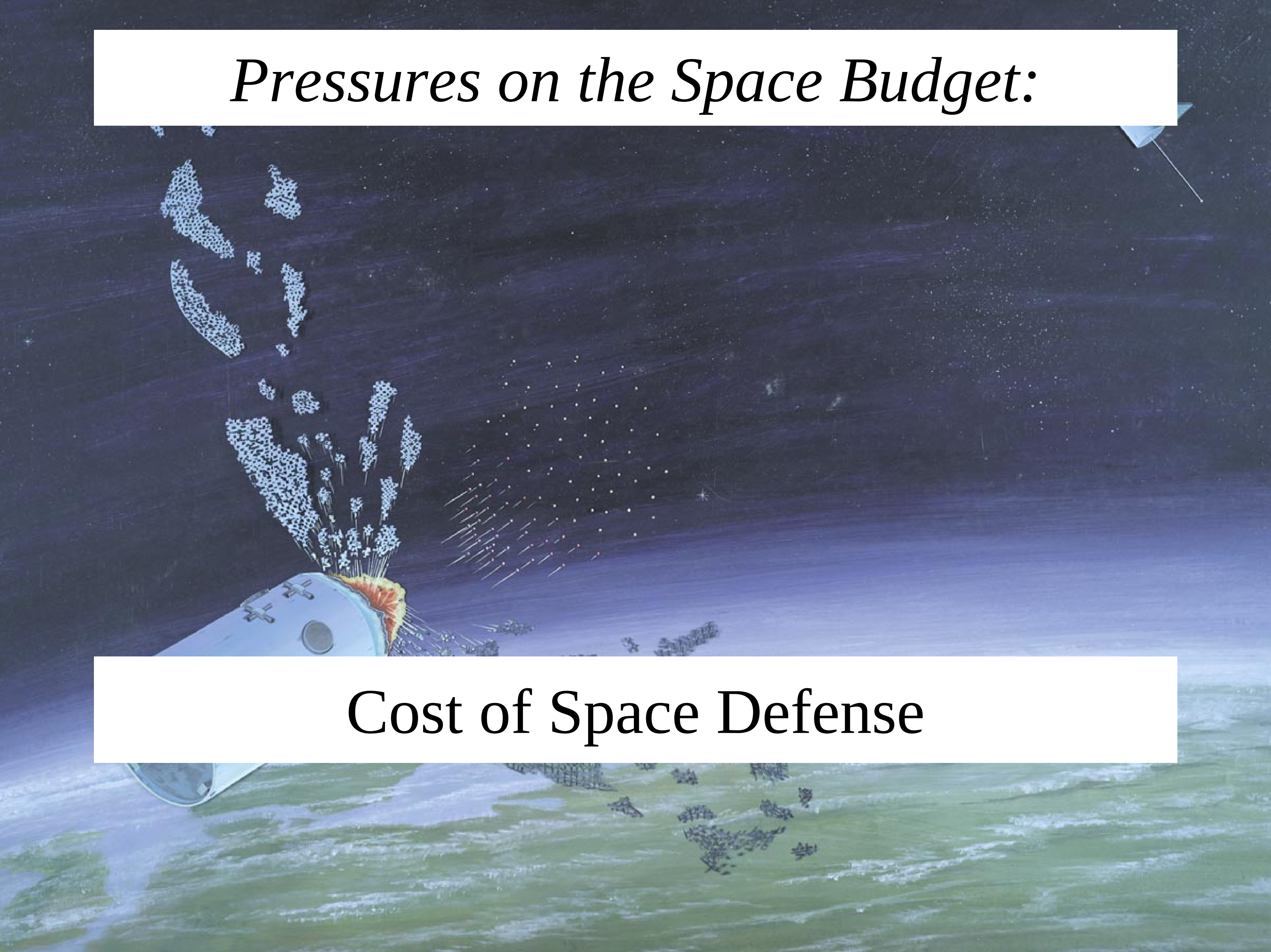


Pressures on the Space Budget:



Deficit

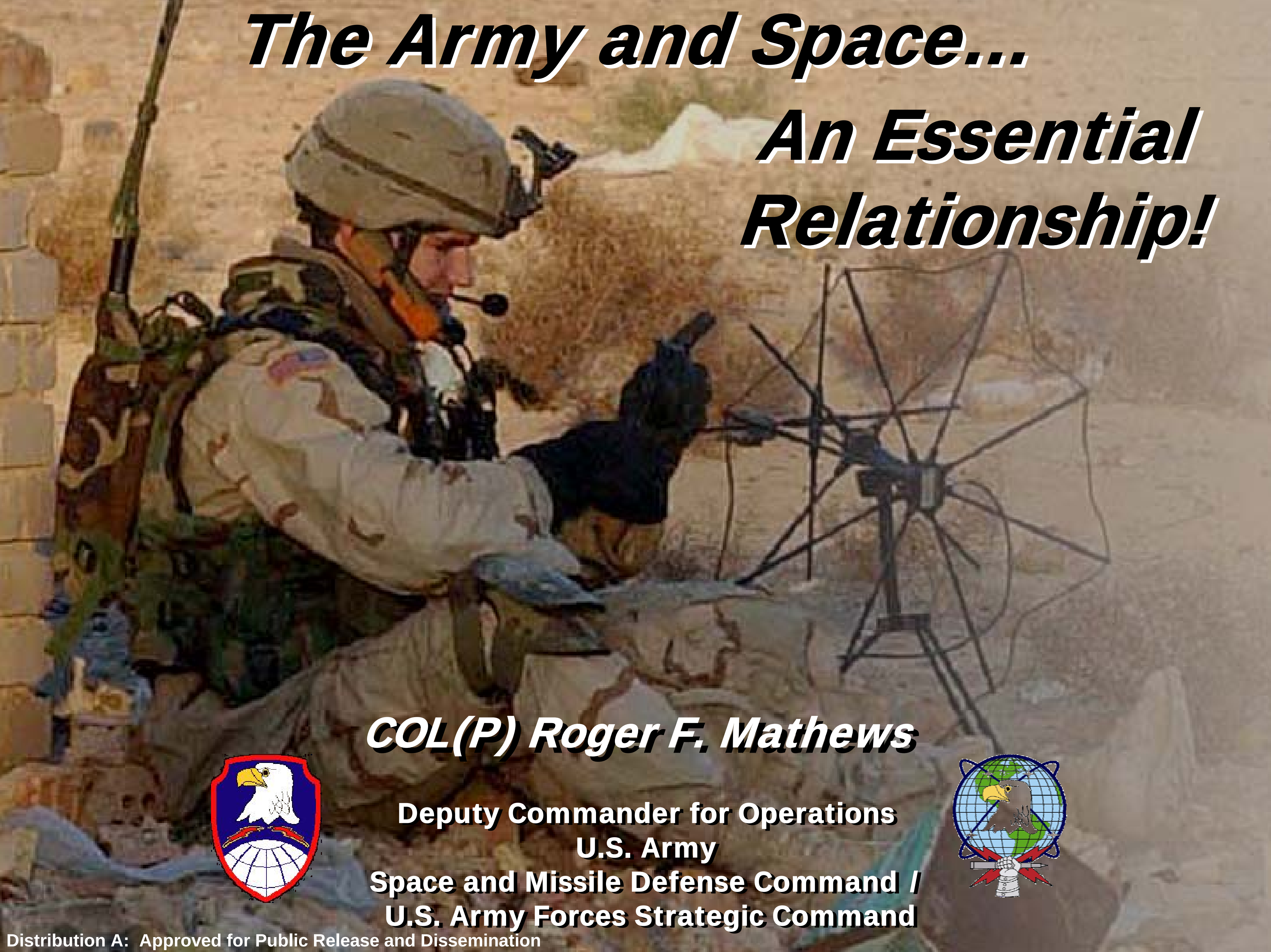
Pressures on the Space Budget:



Cost of Space Defense

The Challenge of Turning Architectures into Capabilities:

Deciding what to give up



The Army and Space…
An Essential Relationship!

COL(P) Roger F. Mathews

Deputy Commander for Operations
U.S. Army
Space and Missile Defense Command /
U.S. Army Forces Strategic Command

Your Army – Serving The Nation…

From Combat Operations…

- 236,000-plus Soldiers deployed overseas in 80 countries
- Composed of adaptive & innovative Soldiers
- Led by experienced leaders
- Enabled by advanced technologies

… to Disaster Relief and Humanitarian Assistance Operations

Smart, well-trained Soldiers are the key to success

US Strategic Command

Provide the nation with **global deterrence capabilities** and **synchronized DoD effects** to combat adversary weapons of mass destruction worldwide. Enable decisive global kinetic and non-kinetic combat effects through the application and advocacy of integrated ISR, space and global operations, information operations, integrated missile defense and robust command and control.

Mission Areas

Global Command & Control

Space Operations

Integrated Missile Defense

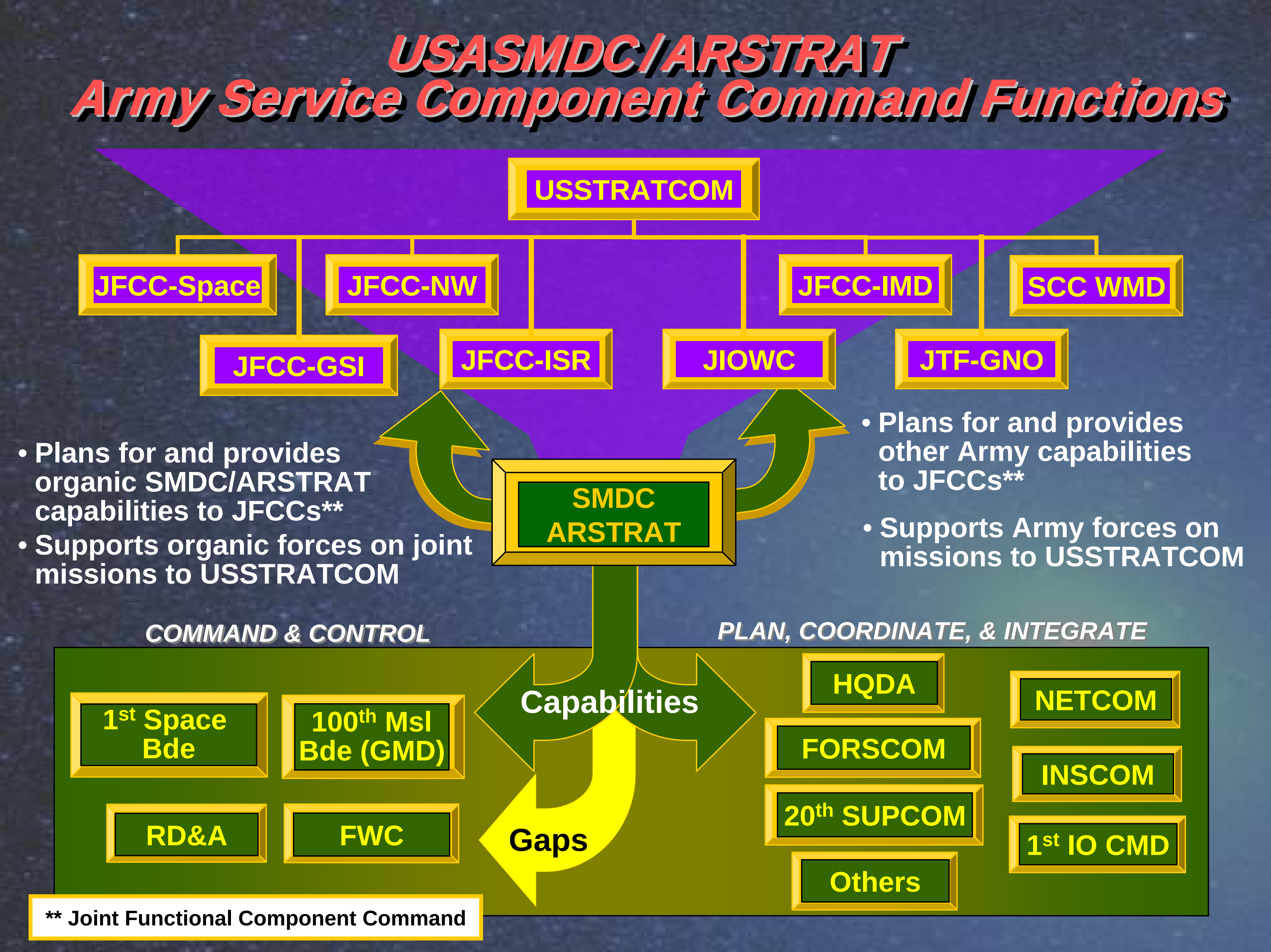
Intelligence, Surveillance and Reconnaissance

Information Operations

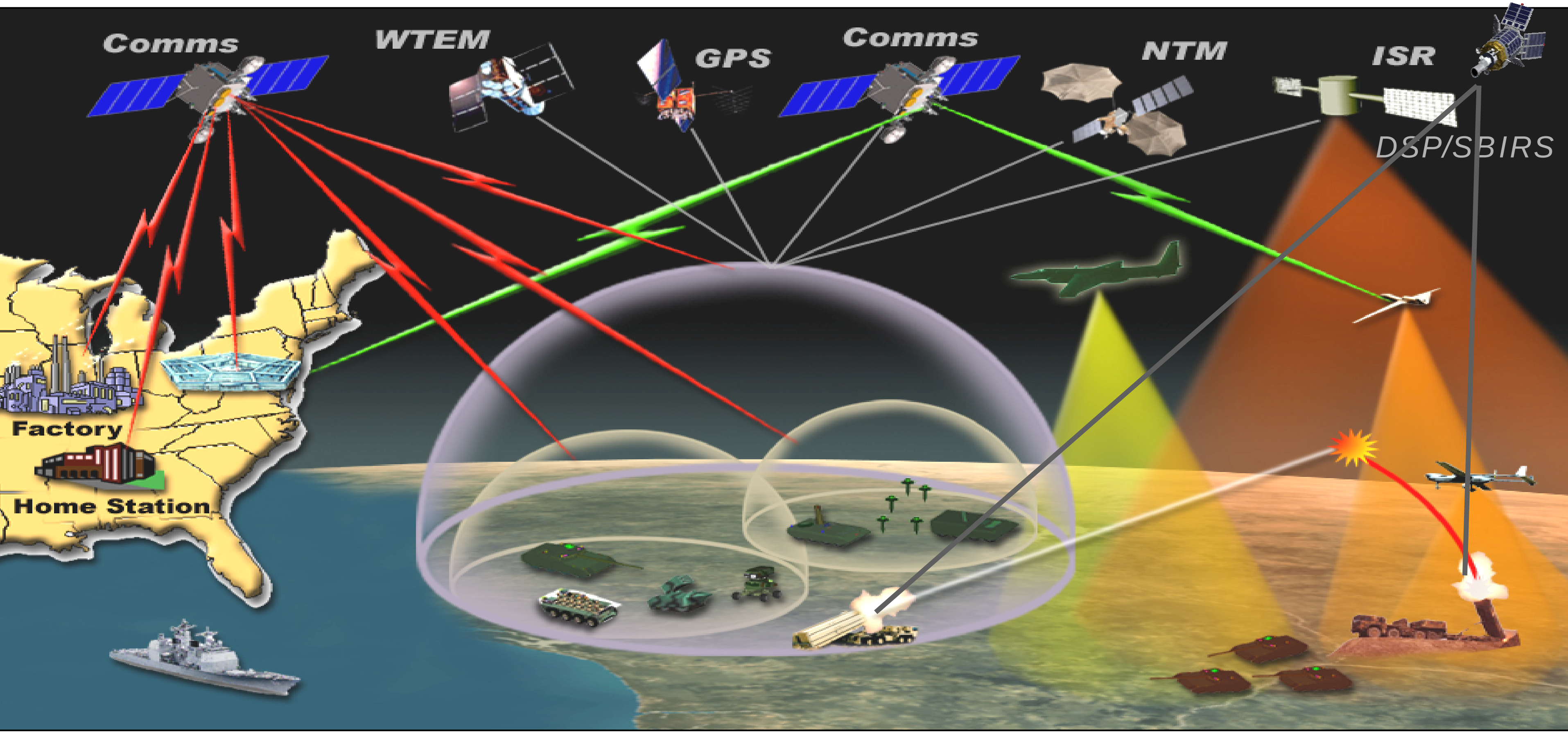
Global Strike

Strategic Deterrence

Combating Weapons of Mass Destruction

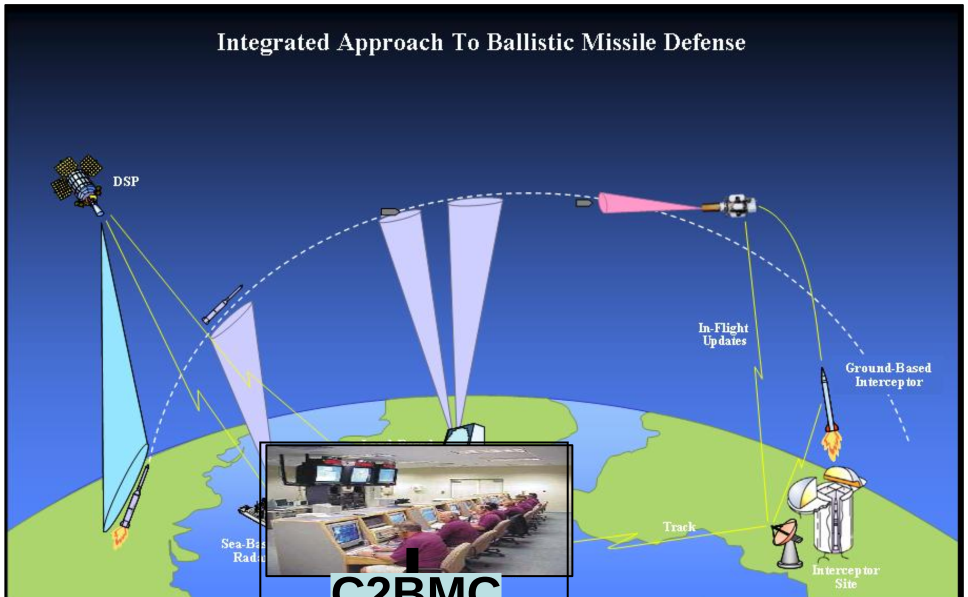

USASMDC/ARSTRAT
Army Service Component Command Functions
USSTRATCOM
JFCC-Space
JFCC-NW
JFCC-IMD
SCC WMD
JFCC-GSI
JFCC-ISR
JIOWC
JTF-GNO
• Plans for and provides organic SMDC/ARSTRAT capabilities to JFCCs**
• Supports organic forces on joint missions to USSTRATCOM
SMDC ARSTRAT
• Plans for and provides other Army capabilities to JFCCs**
• Supports Army forces on missions to USSTRATCOM
COMMAND & CONTROL
PLAN, COORDINATE, & INTEGRATE
1st Space Bde
100th Msl Bde (GMD)
RD&A
FWC
Capabilities
Gaps
HQDA
FORSCOM
20th SUPCOM
Others
NETCOM
INSCOM
1st IO CMD
** Joint Functional Component Command

Operationalizing Space



- Enable, extend, protect the network (Joint C2/NECC)
- Provide responsive space sensors for battlespace awareness
- Enable engagements out of contact; incorporate non-kinetic effects
- Improve logistics capabilities

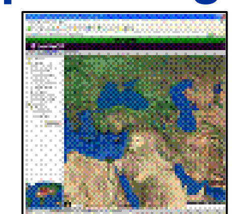
Integration - Net-Enabled Command Capability (NECC)



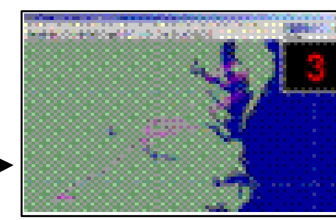
C2BMC

New test moves Integrated Missile Defense Command & Control Battle Management & Communication (C2BMC) toward net-centric operations

Pushes situational awareness & planning to DoD C2 users



DoD users of C2BMC information



C2BMC NECC Services

- Situational Awareness
- Planning

Ballistic Missile Defense picture

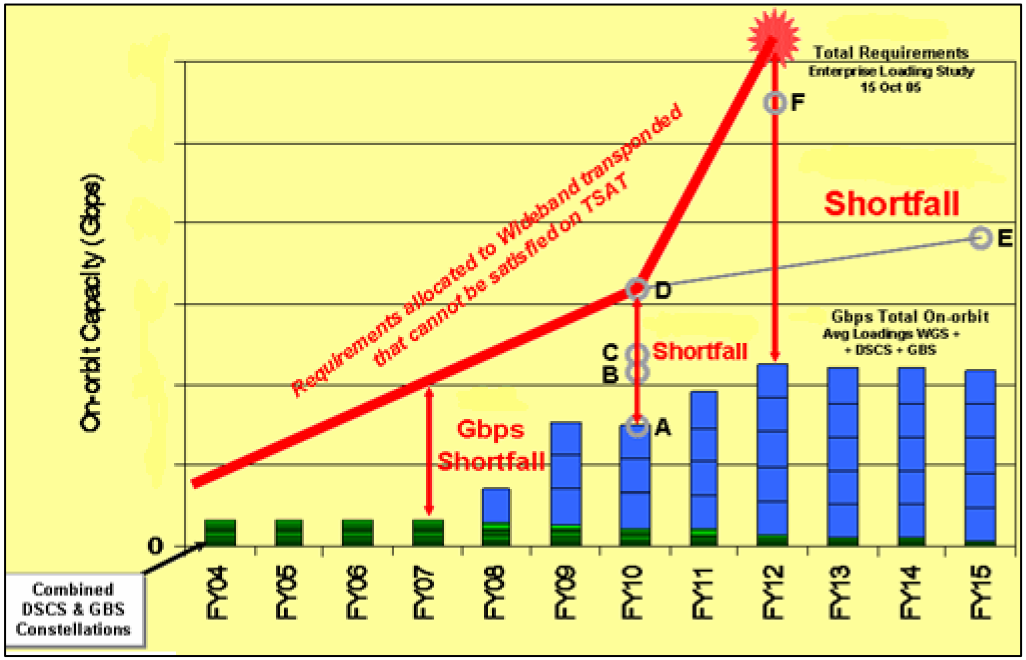
- Threat/ interceptor tracks
- Engagement information

SIPRNET

Net-enabling services: Registry, Security, Common Data Source Adaptor

Capabilities Gap

Projected Wideband Shortfall Over Time



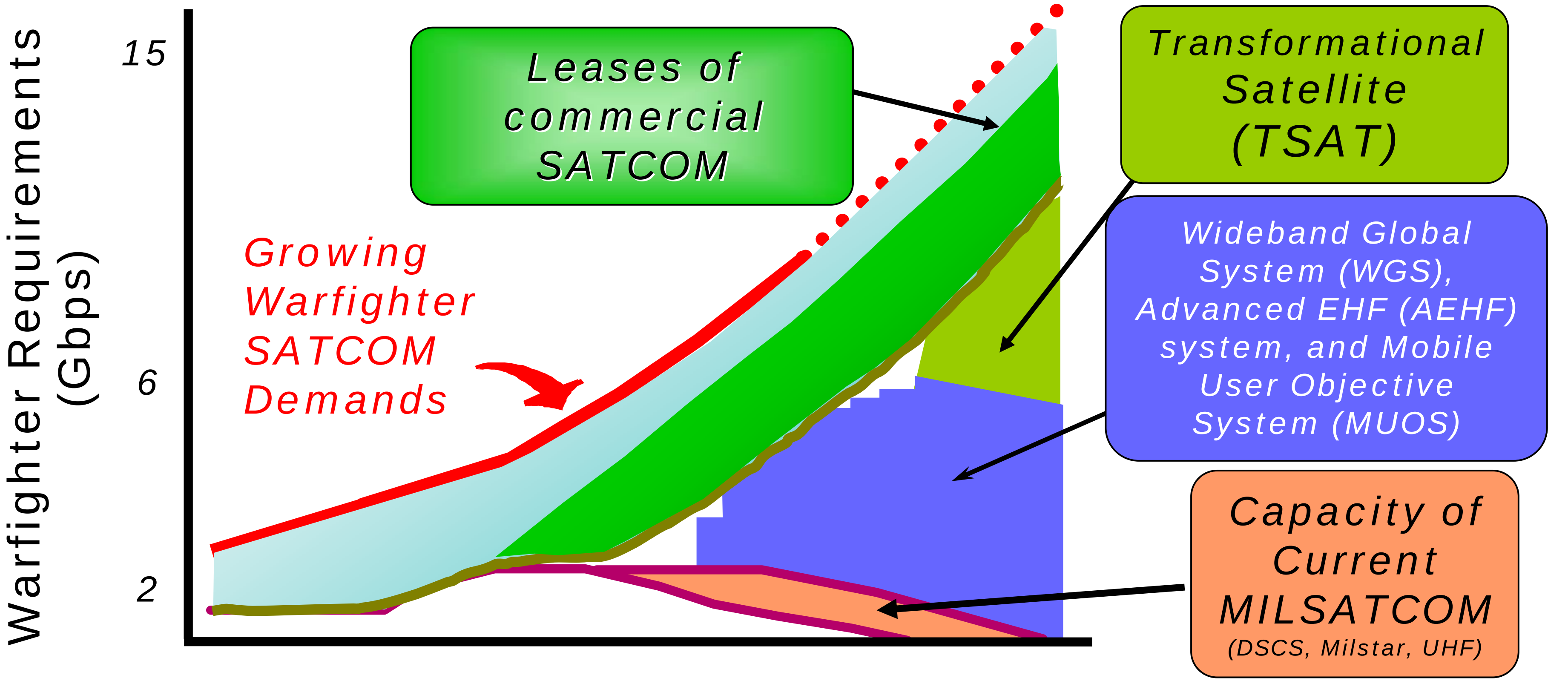
- **Capacity shortfalls will continue**
- **Size of identified gaps grow as**
  - Schedules for next generation systems are stretched
  - Performance of next generation systems is reduced

Warfighter Impact

- **Gaps increase risk to future operations for USPACOM**
  - Available Military and Commercial SATCOM is limited
  - OPLAN requirements are stressing
- **Increased risk to the Global War On Terrorism**
  - *Available* commercial SATCOM *capacity is heavily committed to CENTCOM*
  - *SATCOM needed to support a second major operation may exceed combined remaining military & commercial capacity*
- **Increased cost for operations**
  - *More* leases for Commercial SATCOM *to fill gaps* left by military systems

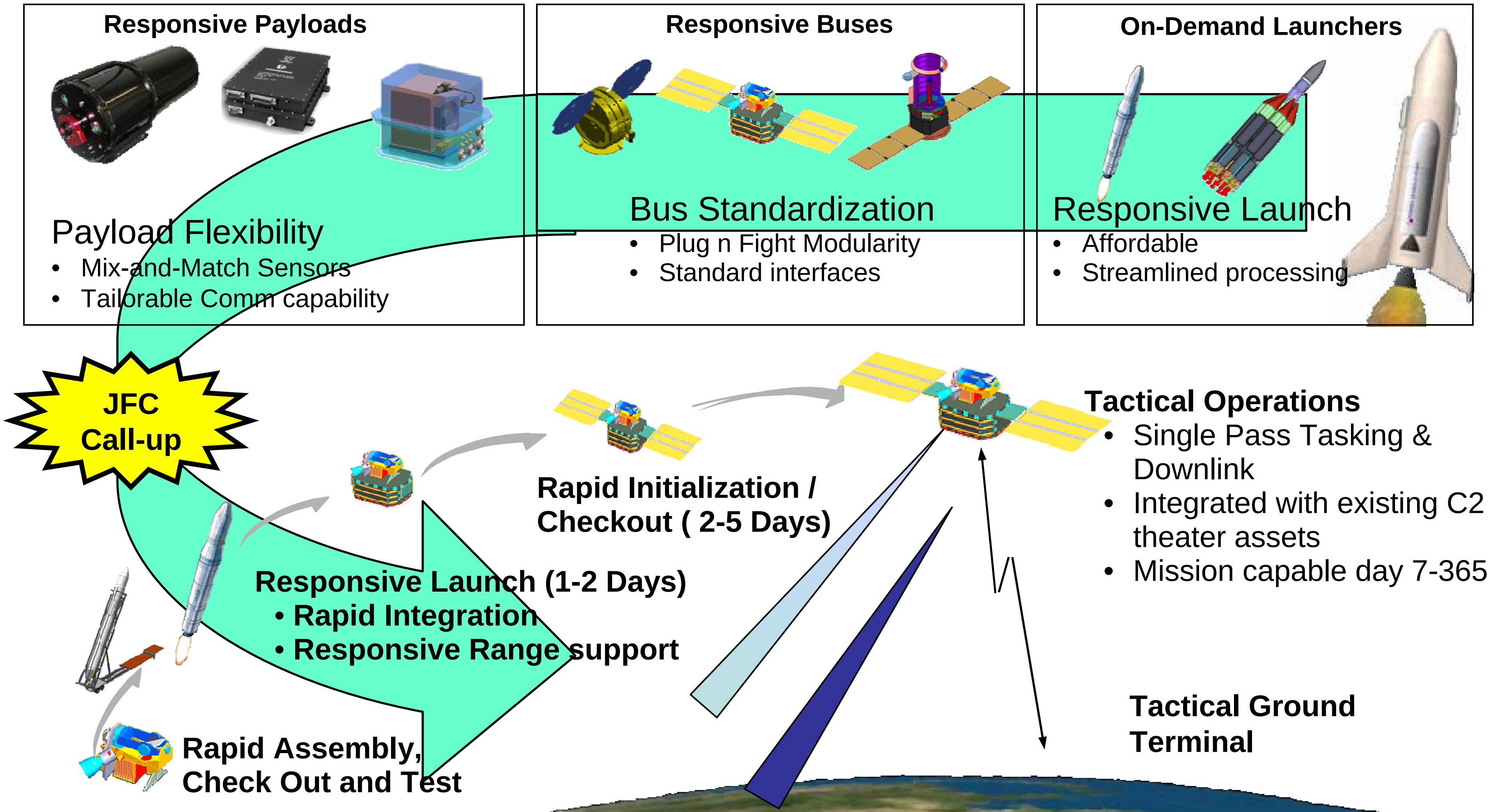
Keep SATCOM Programs On-Schedule and On-Performance

SATCOM Requirements



Increasing requirements exceed capacity of DoD owned & operated MILSATCOM systems

Operationally Responsive Space Concept



Operationally Responsive Space is Affordable, Organic & Responsive!

Working Together – Jointly!

- The warfighter needs to be involved from the beginning…and kept engaged through each step in the process.
- Government does not have all the answers…industry is vital to the solution.
- Capabilities must catch up with requirements.

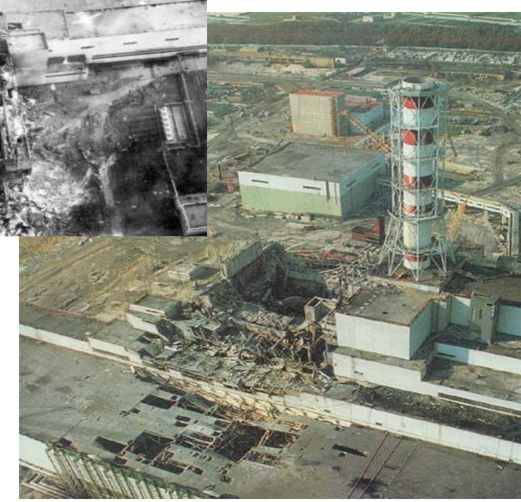
The Warfighter is the centerpiece of all we do!

Disasters In Space

Mr. Gary Payton
Deputy Under Secretary for Space Programs

Chernobyl Power Station, Reactor 4, 04/26/86

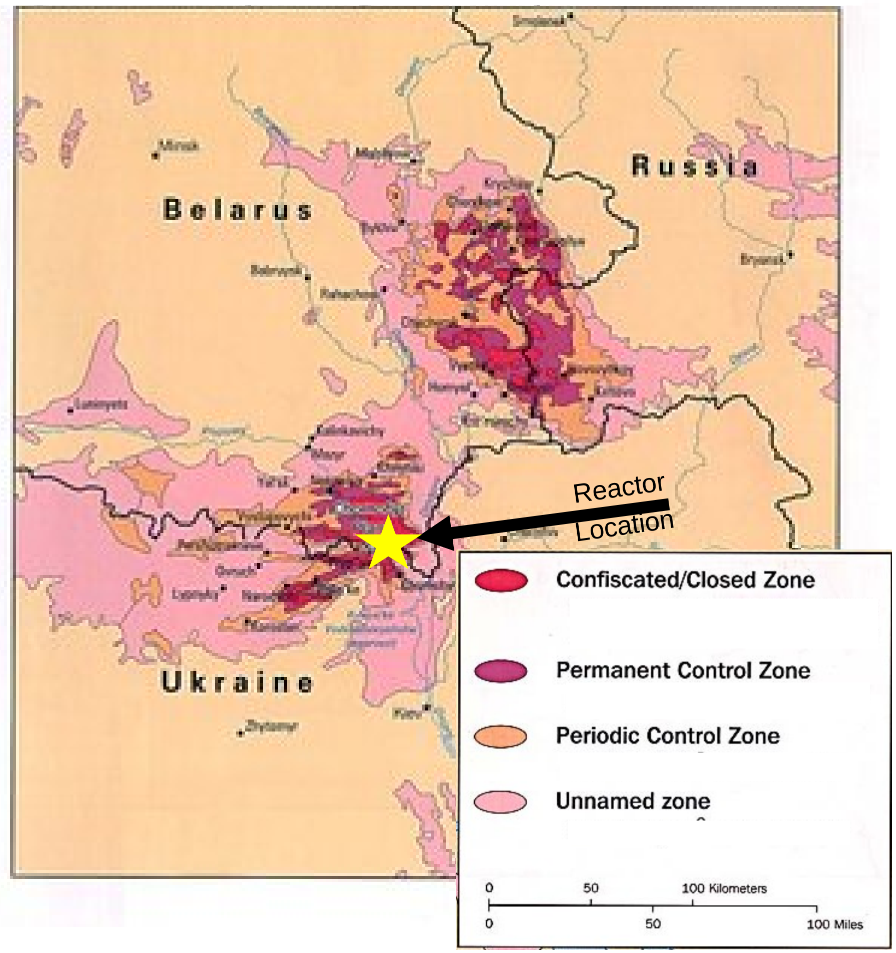
Root Causes:



- Basic reactor design
- Automatic safety system turned off
- Poorly designed experiment
- Decision to continue with experiment even though reactor went unstable
- Operator failure to adapt to new realities

Chernobyl shared traits common to disasters:

- Everything was working well one moment and not the next
- Root causes that "could" have been recognized and, if acted on in time, might have made it possible to avoid or at least mitigate the consequences



Positive example of how to understand root causes and mitigate consequences

World War II - Liberty Ships

- 30% of Liberty fleet experienced catastrophic structural failure
- Recognition of “root” cause: small cracks in welded steel
- Crews taught to spot cracks and initiate simple fix
  - Drilled a hole
  - Became “CRACK STOPPERS”

Lessons from History – the Evening News

Space "mishaps" often make a bang, a fire ball, and the evening news

Vanguard 1 - U.S. response to Sputnik, started off with a loud bang!

Soviet Space program had similar mishaps

Nedelin disaster, October 1960

- Prototype R-16 ICBM exploded on launch pad
- 126 deaths including the commander of the R-16 program …Marshall Nedelin

Lessons From History - Soviet Space

- Nedelin disaster left Moscow without an improved ICBM to compensate for the delays in the R-16 program,   Nikita Khrushchev risked installation of inter-mediate range ballistic missiles in Cuba
  - Led to the Cuban Missile Crisis
  - Almost led to World War III
- Bottom line is that relatively “small disasters” in our space business can lead to horrific consequences

U.S. has had several mishaps that resulted in loss of the crew

Challenger – STS 51-L

- Root cause KNOWN:
  O-Ring leaks and temperature limits
- Root cause became LETHAL when paired with artificial schedule imperative

Lessons From History – Columbia

Columbia – STS-107

- Root cause KNOWN:
  Foam was falling off and hitting the external tanks & shuttles during launch
- Root cause became LETHAL when paired with artificial schedule imperative

Lessons From History – Unmanned

UNMANNED space programs have also suffered launch and on-orbit mishaps

- Mars Climate Orbiter
- Mars Polar Orbiter
- European Mars Lander
- Titan 34D
- Delta

Two examples:

- SBIRS High – Space Based Infrared System
- NPOESS – National Polar Orbiting Environmental Satellite System
- Both suffered Nunn-McCurdy Breaches
  - Ultimately Certified …
  - But with draconian reductions in scope … to control costs
  - And, to give current program managers a fighting chance to deliver on promises made

We Stepped Away From the "BASICS"!

Root Causes – Young Report

1. Using "cost as primary driver"
2. Starting program with unrealistically low cost estimates and budgeting
3. Failing to provide discipline in requirements definition and growth
4. Erosion in Government's ability to lead and manage
5. Industry failed to implement proven acquisition practices

“Back to Basics” Acquisition Strategy

- Center on requirements, resources, & risks
  - Manage technology risks, funding risks, and schedule risks
  - Stabilize requirements
- “Block Approach”
- Build deliberate incremental delivery plans with renewed emphasis on requirements, resource and management

“Back to Basics” Acquisition Strategy

- Stabilized requirements, budgets, and workforce
- Document incremental capabilities with a approved Acquisition Program Baseline
- Match deliveries to changes in tactics, techniques, procedures and user equipment

Must Reduce the Cycle Time

“Back to Basics” Implementation

- Emphasize delivering initial capability
- Manage program risks
- Manage expectations
- Stabilize budgets
- Identify most critical technologies and align them with incremental delivery plan
- Maintain and grow experienced, professional space acquisition and engineering cadre

Summary

- Not all disasters make the evening news
  - We have experienced disasters in our space acquisition programs
  - These disasters can have impacts that are far greater than those associated with a single mishap

We must all be “Crack Stoppers”
We must get “Back to Basics”

Operationally Responsive Space

Now Is The Time to Step-Out Smartly

Mr. Joseph D. Rouge

National Security Space Office

2 February 2007

The Convergence of Many Forces

- Growing US Need for Responsiveness
- TACSAT Programs
- Back-to-Basics Acquisition Approach
- High Rate of Change of Technology
- Responsive Space Operations Architecture
- Congressional Interest
- Emerging threats (e.g. Chinese ASAT Testing)

Operationally Responsive Space:
Four Ideas with the Same Name*

“Operational Level of War vs. Strategic Mission”

- (OPERATIONALLY responsive space (Ors))
- Put combatant commanders in charge

“Change the economics of space”

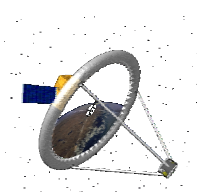
- (operationally RESPONSIVE space (oRs))
- Smaller and simpler satellites in shorter timeframes

“Surge and Replenish”

- (operationally responsive spaceLIFT (ors-L))
- Requires responsive launch and spacecraft

* From Dr. S. Huybrechts, OASD(NII), “Thoughts on Space Power in the 21st Century”

“Technology Push”



- (operationally responsive SPACE (orS))
- Use small satellites to drive technology insertion

Operationally Responsive Space Goals

CONNECT SPACE TO THE USER:

– Make space capabilities more relevant to joint force commanders and more adaptable to future joint force needs

RESPOND TO THE URGENT NEED:

– Deliver effects to joint warfare in response to an urgent or previously unanticipated need

REDUCE DEVELOPMENT/DEPLOYMENT TIME AND COST:

– Complement NSS architecture with an element focused on increased value and timely delivery

CAPITALIZE UPON EMERGING/INNOVATIVE CAPABILITIES:

– Motivate and adopt new capabilities from advanced technologies, innovative operational concepts, and benefits from data integration, information sharing, and net-centricity

Potential Responsive Space Applications

Missions

- Battlefield ISR (hyper-spectral imaging, etc.)
- Communications
- Blue Force Tracking
- Position Navigation & Timing (PNT)
- Weather
- Space Superiority

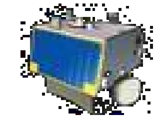
Feasible Applications Exist

Payload Capabilities

- Imagery
  - Synthetic aperture radar
  - Panchromatic, Multi-spectral, Hyper-spectral, Infrared
- Communications
  - Standard, Covert, Store and Forward
  - RF transmit, broadcast, relay, UAV support
- Radio Frequency
  - ELINT, battlefield geolocation
  - SIGINT, real-time detect radars
  - RF scan, detect new targets
- Weapon Support
  - PNT / GPS augmentation
  - Non-imaging infrared

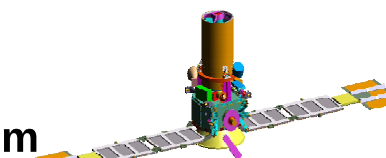
Operational Experimentation

- **UK TopSat**
  - Conducting operational experiments with UK's low cost imaging spacecraft already on orbit
- **TacSat-1 (Lead: NRL for OSD/OFT)**
  - Dual-mode target identification using Specific Emitter Intelligence (SEI)
  - Estimated launch April 07 Space-X Falcon-I
- **TacSat-2 (Lead: AFRL/VS)**
  - Provides enhanced SEI & Automatic Identification Systems and ~1m resolution imagery, tactical tasking & data dissemination
  - Proposed launch 16 Dec 2006
- **TacSat-3 (Lead: AFRL/VS)**
  - Hyper-spectral and panchromatic imagery directly to tactical user or to CONUS data center, On-board data processing
  - Estimated launch Fall 2007
- **TacSat-4 (Lead: NRL)**
  - "Comm on the Move", Data Exfiltration and Blue Force tracking
  - Launch ready 2008

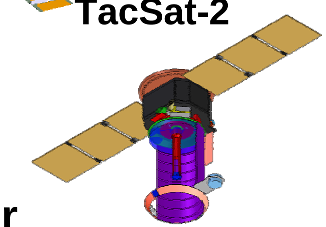


TopSat

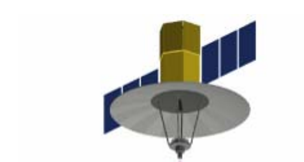
TacSat-1



TacSat-2

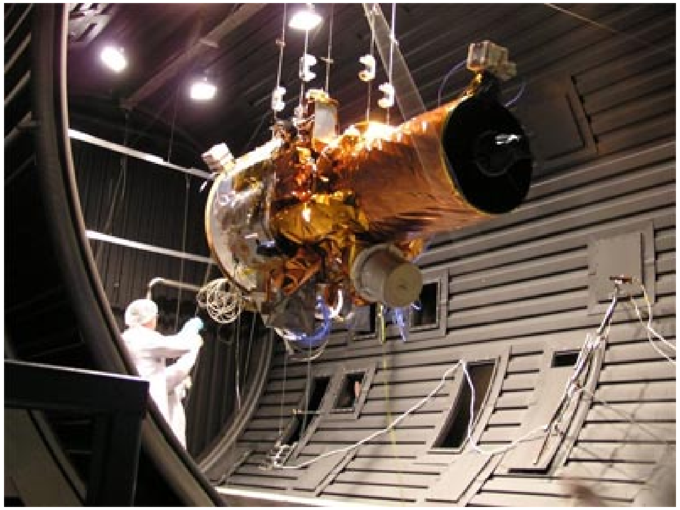


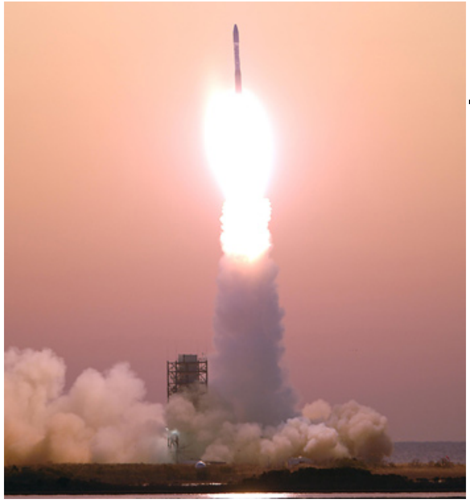
TacSat-3



TacSat-4

Tactical Satellite (TacSat)-2 Experiment





Successful Launch, 16 Dec 06, Orbital Minotaur

Ground Terminal – China Lake

Capability:

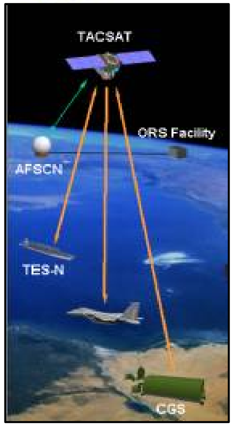
- **Field tasking/data downlink in same pass**
- **One meter tactical imagery**
- **Specific emitter ID & geolocation**
- **Dynamic retasking, cooperative with EP-3**
- **Autonomous tasking/checkout/on-orbit maintenance, on-board data processing**
- **Total mission cost w/ launch ~$63M**

Status:

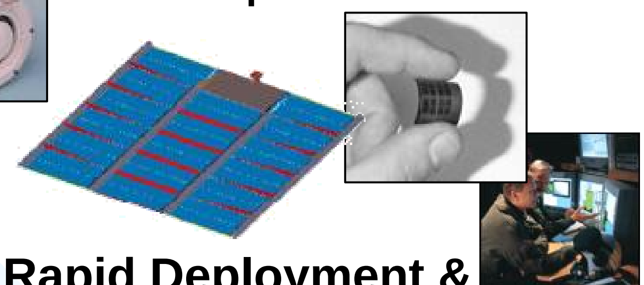
- **First of TACSAT series on-orbit**
- **18 month development to launch cycle**
- **Utilized the Minotaur launch vehicle**
- **Launched from Wallops Island Facility 16 Dec 2006**
- **Successfully commanded spacecraft from China Lake ground station**

Responsive Satellite Enabling Technology

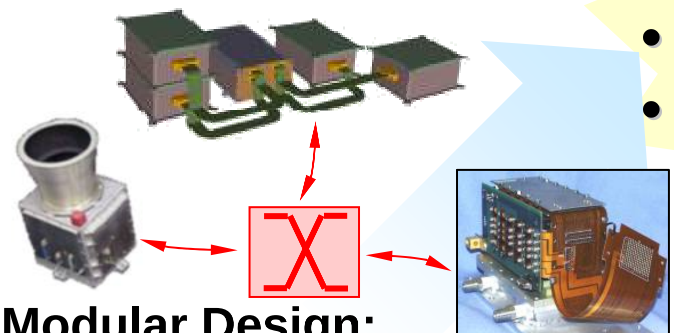
- **Tactical Operations and Data Dissemination:**
  - Integrated with existing ISR C2
  - Must fit into existing warfighting architecture
  - Decision quality data to the warfighter



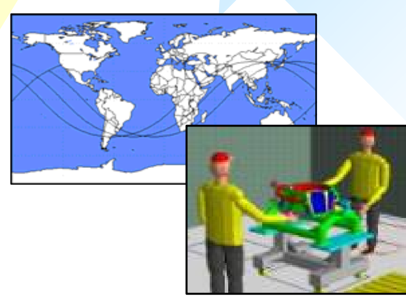
- **Advanced Small / Microsat Technologies:**
  - Lightweight, low cost apertures
  - Advanced power
  - Efficient propulsion
  - Low cost rad-tolerant components



- **Responsive**
- **Affordable**
- **Employable**
- **Integrated**



- **Modular Design:**
  - Plug 'n play architecture
  - Standard, open architecture interfaces

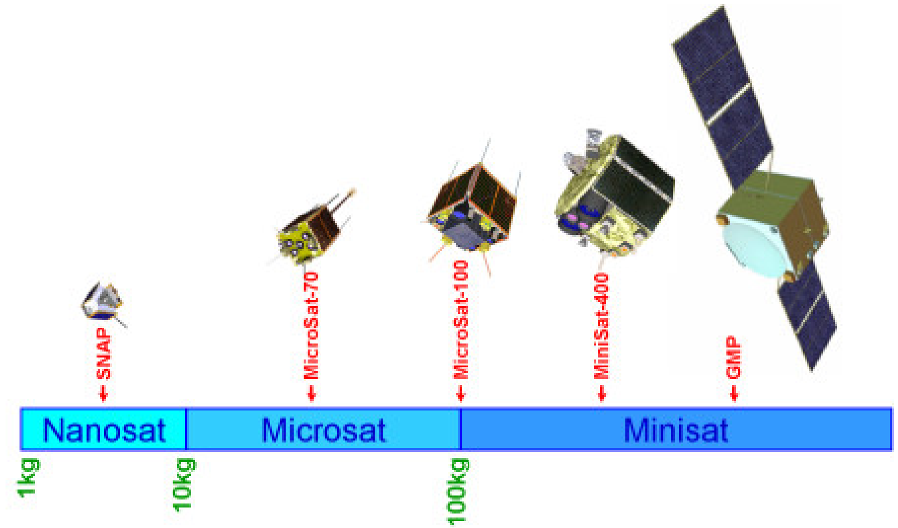


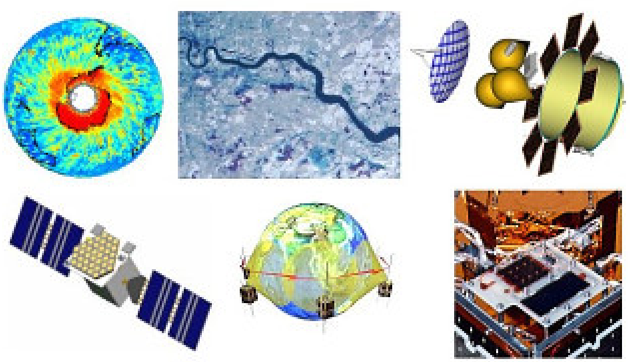
- **Rapid Deployment & Ops:**
  - Mission planning tools / tailored orbits
  - Fast assembly and test
  - Rapid autonomous deployment and operations

Investments Being Made Across ORS Enterprise

Surrey Satellite Technology Limited (SSTL)

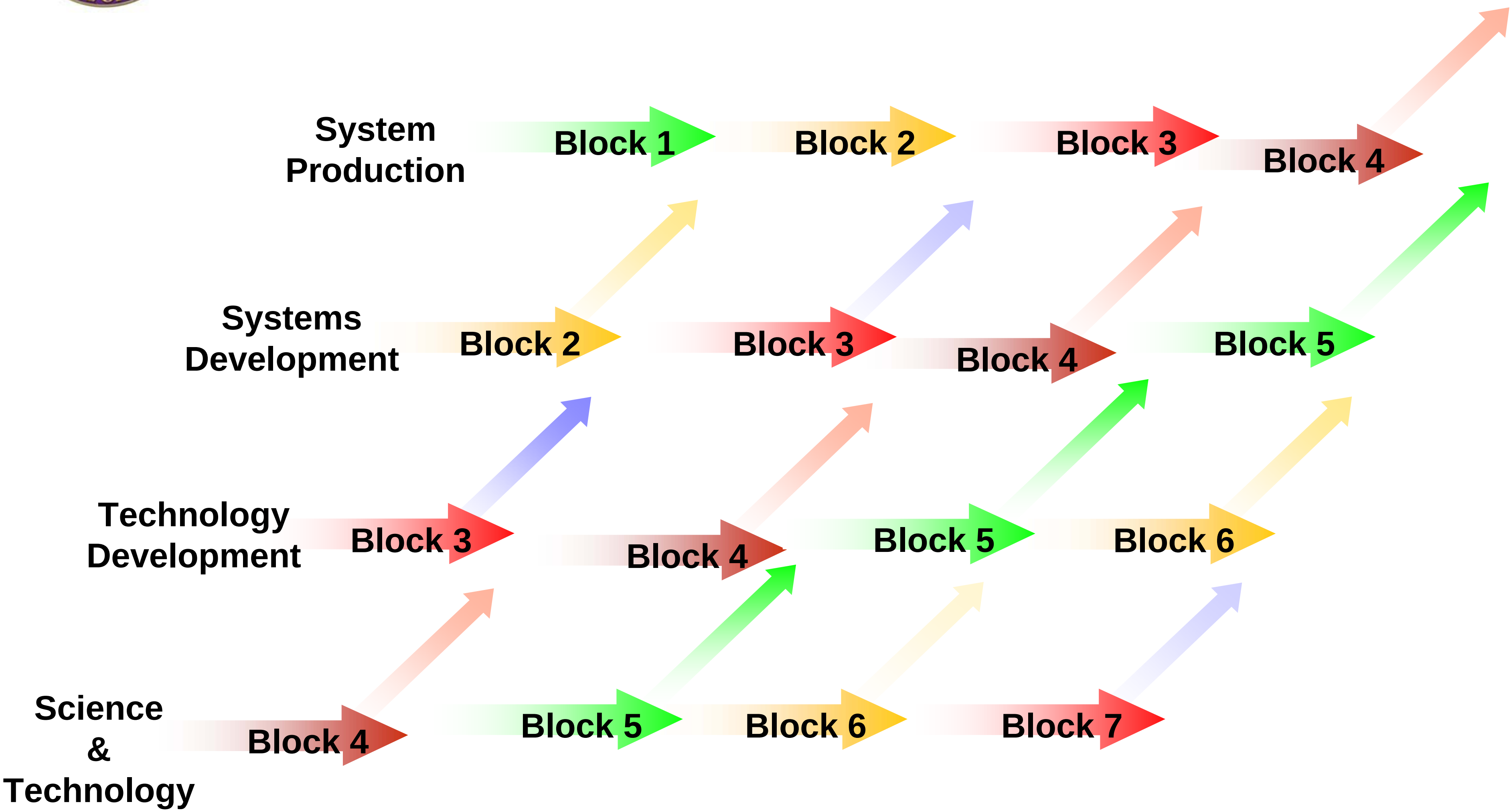
Mission	Year	Launch	Platform	Programme
BEIJING-1	2005	Cosmos	Bespoke	Turnkey
TopSat	2005	Cosmos	Bespoke	Turnkey
UK-DMC	2003	Cosmos	MicroSat-100<>	Turnkey
NigeriaSat-1	2003	Cosmos	MicroSat-100	Knowhow Transfer
BILSAT-1	2003	Cosmos	MicroSat-100	Knowhow Transfer
AISAT-1	2002	Cosmos	MicroSat-100	Knowhow Transfer
PICOSat	2001	Athena	MicroSat-70	Turnkey
Tsinghua-1	2000	Cosmos	MicroSat-70	Knowhow Transfer
SNAP-1	2000	Cosmos	SNAP nanosat	R&D
TiungSat-1	2000	Dnepr	MicroSat-70	Knowhow Transfer
UoSAT-12	1999	Dnepr	MiniSat-400	R&D
Clementine	1999	Ariane	MicroSat-70	Turnkey
FASat-B	1998	Zenit	MicroSat-70	Knowhow Transfer
Thai-Paht	1998	Zenit	MicroSat-70	Knowhow Transfer
CERISE	1995	Ariane	MicroSat-70	Turnkey
FASat-A	1995	Tsyklon	MicroSat-70	Knowhow Transfer
HealthSat-2	1993	Ariane	MicroSat-70	Turnkey
PoSAT-1	1993	Ariane	MicroSat-70	Knowhow Transfer
KITSAT-1	1992	Ariane	MicroSat-70	Knowhow Transfer
S80/T	1992	Ariane	MicroSat-70	Turnkey
UoSAT-5	1991	Ariane	MicroSat-70	R&D
UoSAT-3	1990	Ariane	MicroSat-70	R&D
UoSAT-4	1990	Ariane	MicroSat-70	R&D
UoSAT-2	1984	Delta	microsat	R&D
UoSAT-1	1981	Delta	microsat	R&D



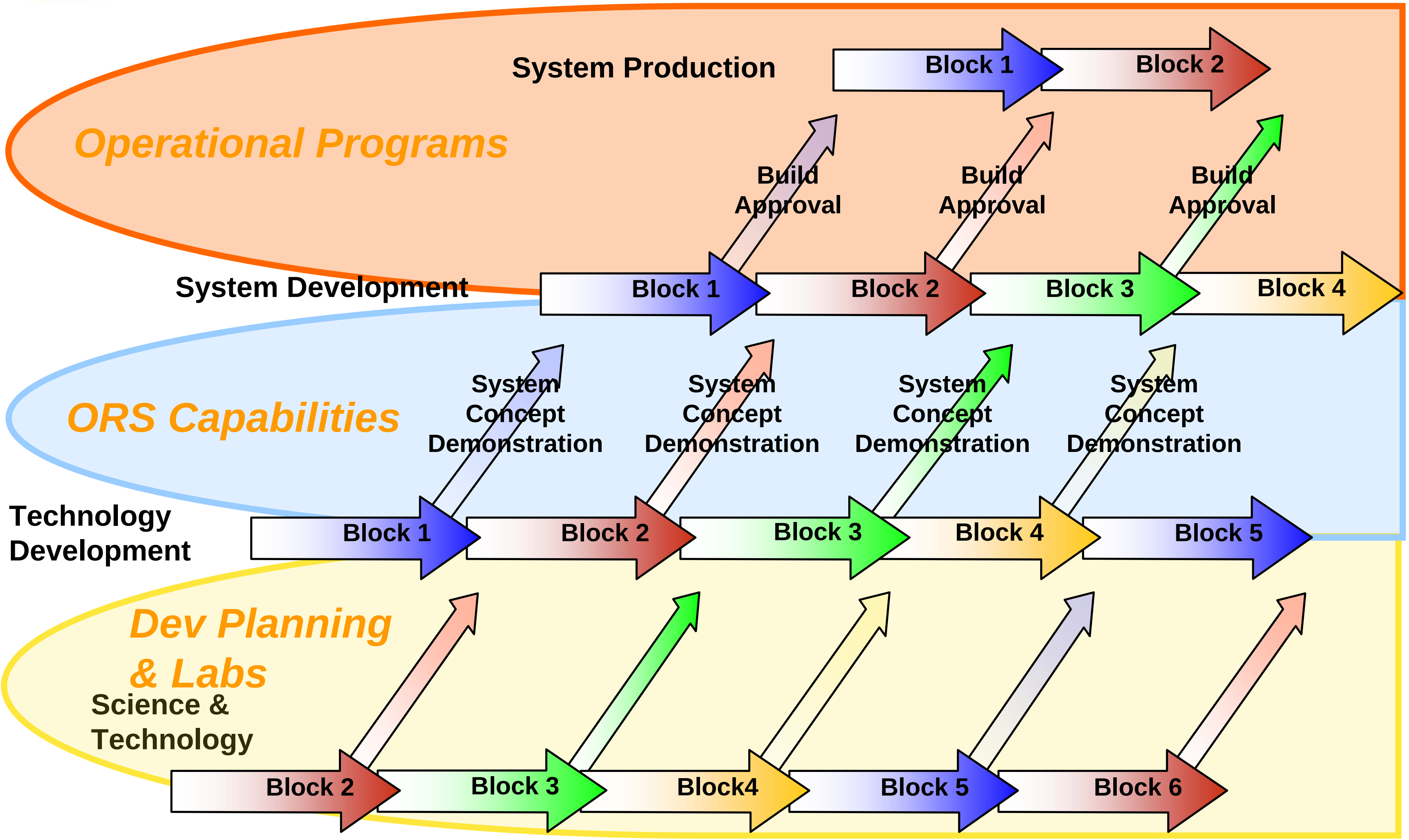


SSTL Leads the World in Small Satellite Mission Development

Acquisition Stages--Block Approach



ORS and the "Block" Acquisition Strategy

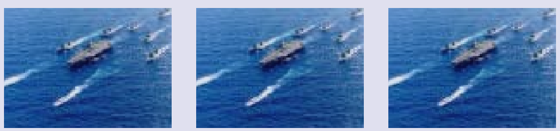
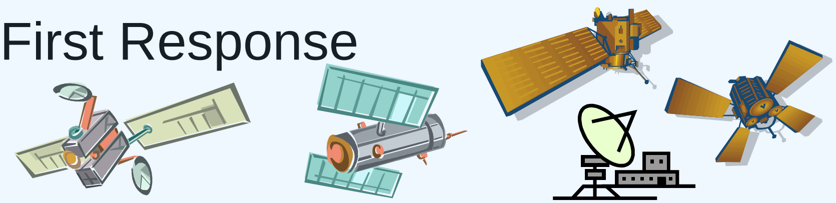
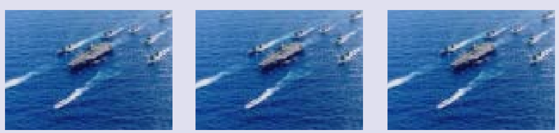
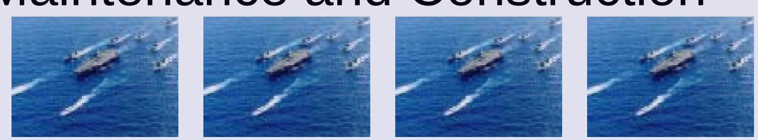


Responsive Space Operations Architecture

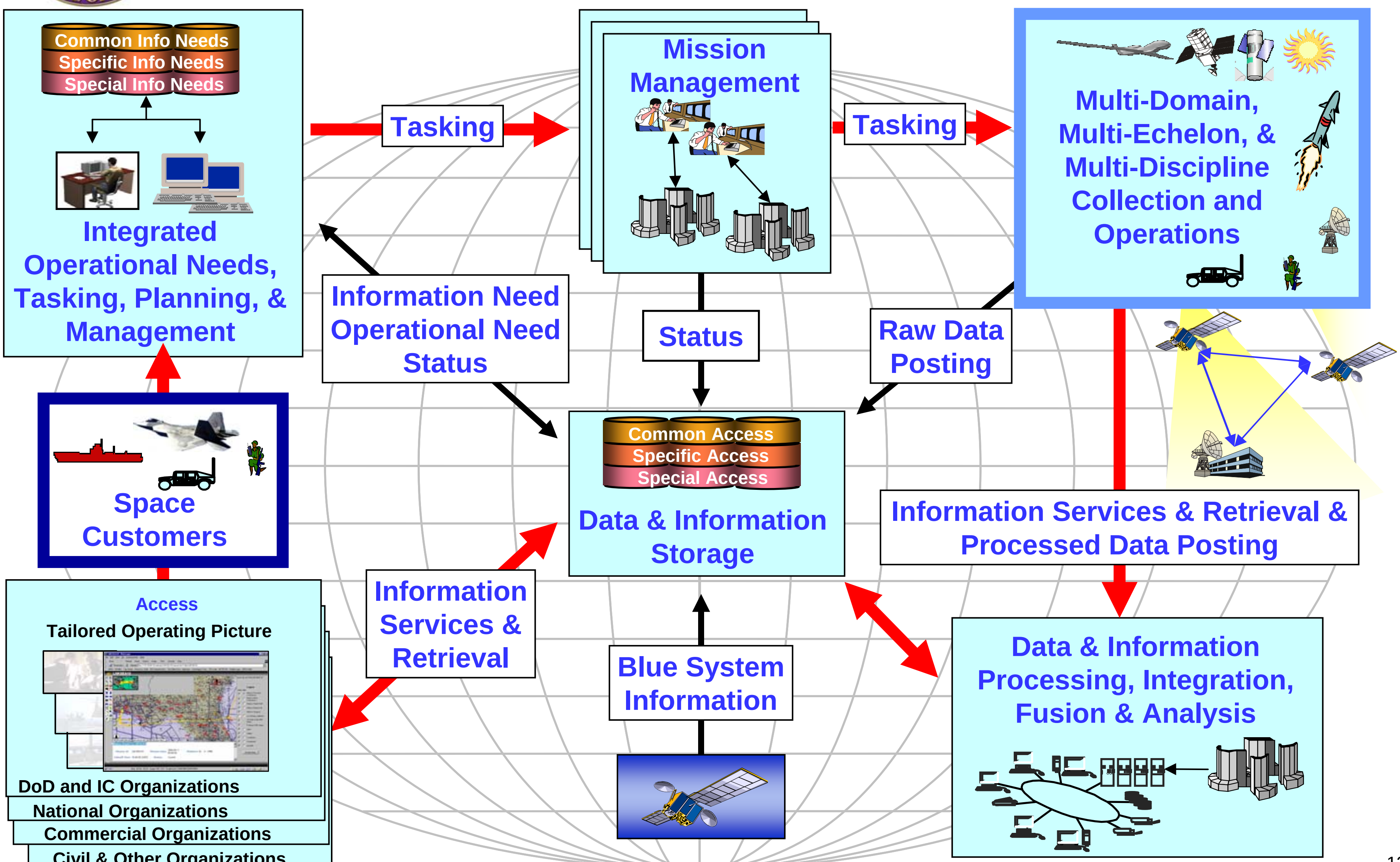
Responsive Reserves against Uncertainty

"It is thus an essential condition of strategic leadership that forces should be held in reserve according to the degree of strategic uncertainty."

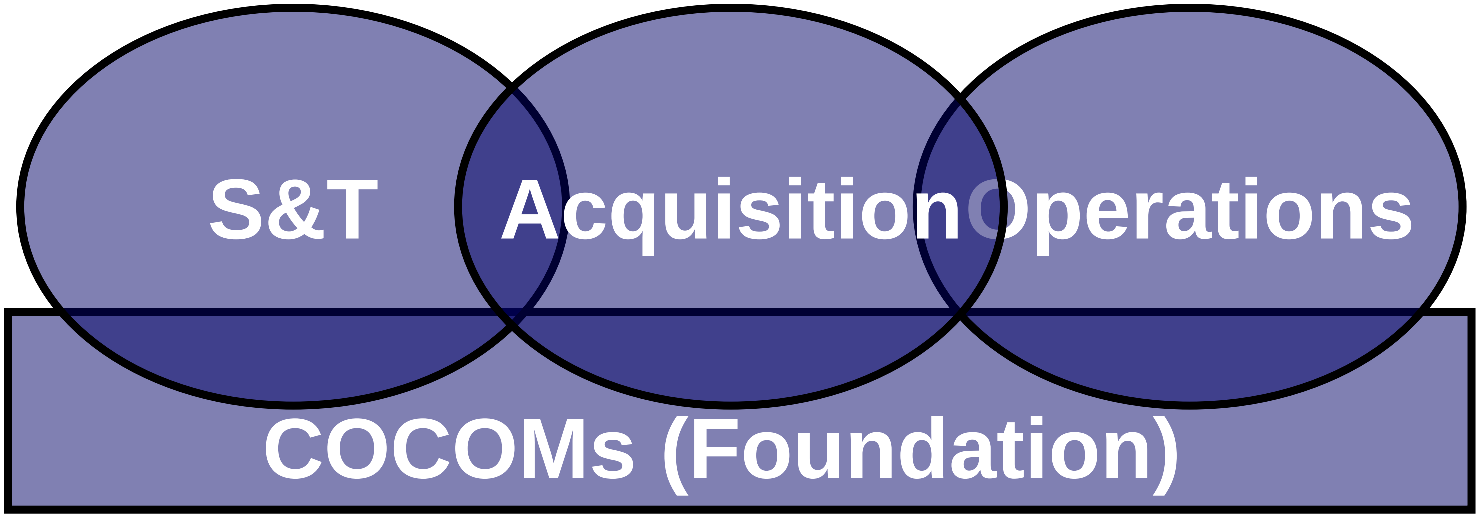
- Clausewitz, *On War*

Customer Reserves	Responsive Space Capabilities
Forward Deployed 	First Response 
30 days  90 days 	On-Call 
Maintenance and Construction 	Fundamental 

RSO Architecture
End-To-End Responsiveness



Mr. Hartman ORS Speech -- 17 Aug 2006



- **COCOMs: Drivers, but need "interpreters" between each organization**
- **"Don't wait for the perfect requirement" "Don't overload projects with S&T"**
- **Near Term Focus: S&T; Tens of $Ms, doled out by the "ORS HQ"**
- **AQ Office: Near Term – 10 people; setting up processes – IDIQs…**
- **Expects '07 to be OFT; '08 to have significant AF budget for ORS**

Congressionally-Directed ORS Plan

- **Who: SECDEF shall submit to the defense committees**
- **When: Due NLT 120 days after enactment: February 14th**
- **What: A plan for the acquisition by the DoD of capabilities for operationally responsive space to support military users and military operations**

Congressionally-Directed ORS Plan

- **Elements of the plan specified for inclusion:**
  - Roles and missions
  - Identification of required capabilities
  - ORS Program Office* chain of command and reporting structure
  - Classification of ORS-related information
  - Description of the acquisition policies and procedures applicable to ORS… and any legislative or administrative action necessary to provide any additional acquisition authority to carry out ORS responsibilities
  - Schedule to implement the Plan and…establishment of the ORS Program Office
  - Funding/personnel required to implement the plan within the FYDP
  - Additional authorities and programmatic, organizational, or other changes to ensure success

Senator Kyl on Chinese ASAT 29 Jan 2007

"The space threat posed by China is multifaceted. The painting in September of a U.S. satellite by a ground-based laser shows that the Chinese program includes a broad range of capabilities, from kinetic kill to directed energy. The January 11th test also show China's ability to hit targets in low Earth orbit where most of American reconnaissance assets are deployed. But reports also suggest that they are seeking the ability to attack satellites in the medium and higher Earth orbit, such as GPS."

Conclusions

- Congressional support sound
- Threat to US Space capabilities emerging
- DOD heavily investing
- Community-wide team charting way ahead

ORS will transform future space operations

The Time is NOW

National Security Space Policy & Architecture Symposium

Dr. Ron Sega

Under Secretary of the Air Force

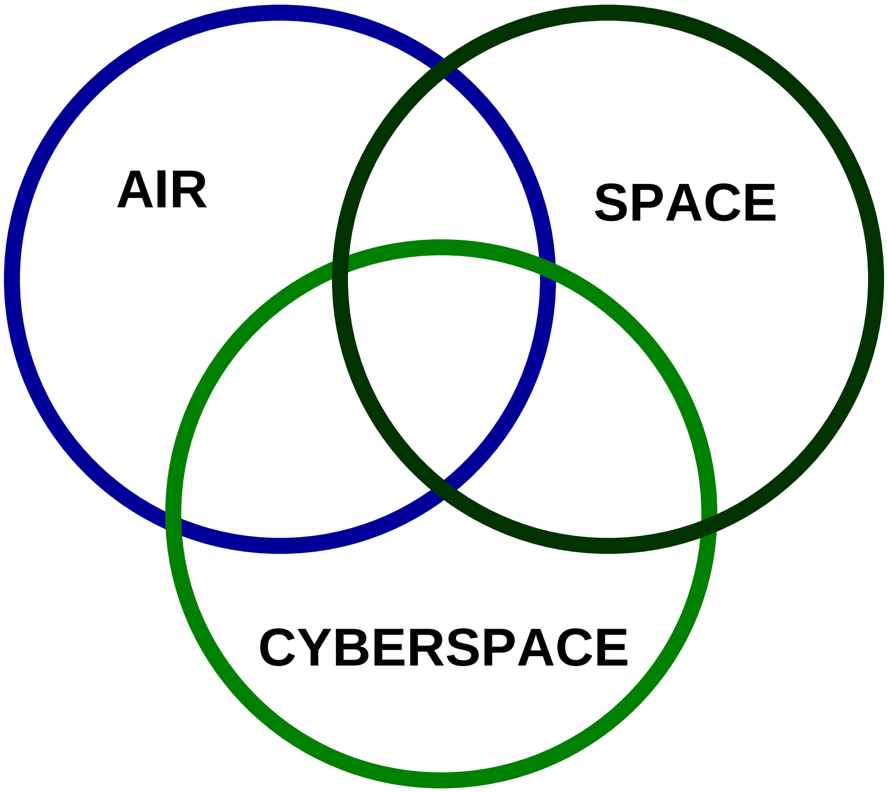
NDIA Participation

- ***Merger of two organizations in 1997:***
  - ***American Defense Preparedness Association and the National Security Industrial Association***
- ***Important mission***
  - ***ADVOCATE: Cutting-edge technology and superior weapons, equipment, training, and support for the War-Fighter and First Responder***
  - ***PROMOTE: A vigorous, responsive, Government – Industry National Security Team***
  - ***PROVIDE: A legal and ethical forum for exchange of information between Industry and Government on National Security issues***
- ***Commitment to Space Partnerships Theme***
  - ***Reflects NDIA's quest for great efficiencies***

Heritage to Horizons

- ***Hap Arnold*: "The *__first essential__ of* the *airpower* necessary for our national security is *preeminence in __research__*."**
- ***Bernard Schriever*: "It may be said that warfare has acquired a new phase - technological war. In the past, research and development were only preparation for the final and decisive testing of new systems in battle. Today the kind and quality of systems which a nation develops can decide the battle in advance and make the final conflict a mere formality - or can - bypass conflict altogether."**
- ***Dwight Eisenhower*: "We should base our security upon military formations which make maximum use of science and technology in order to minimize numbers of men."**

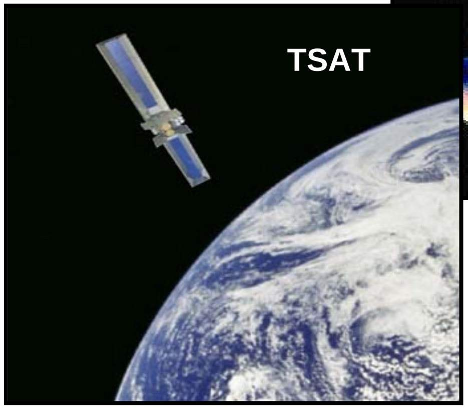
Mission of the United States Air Force



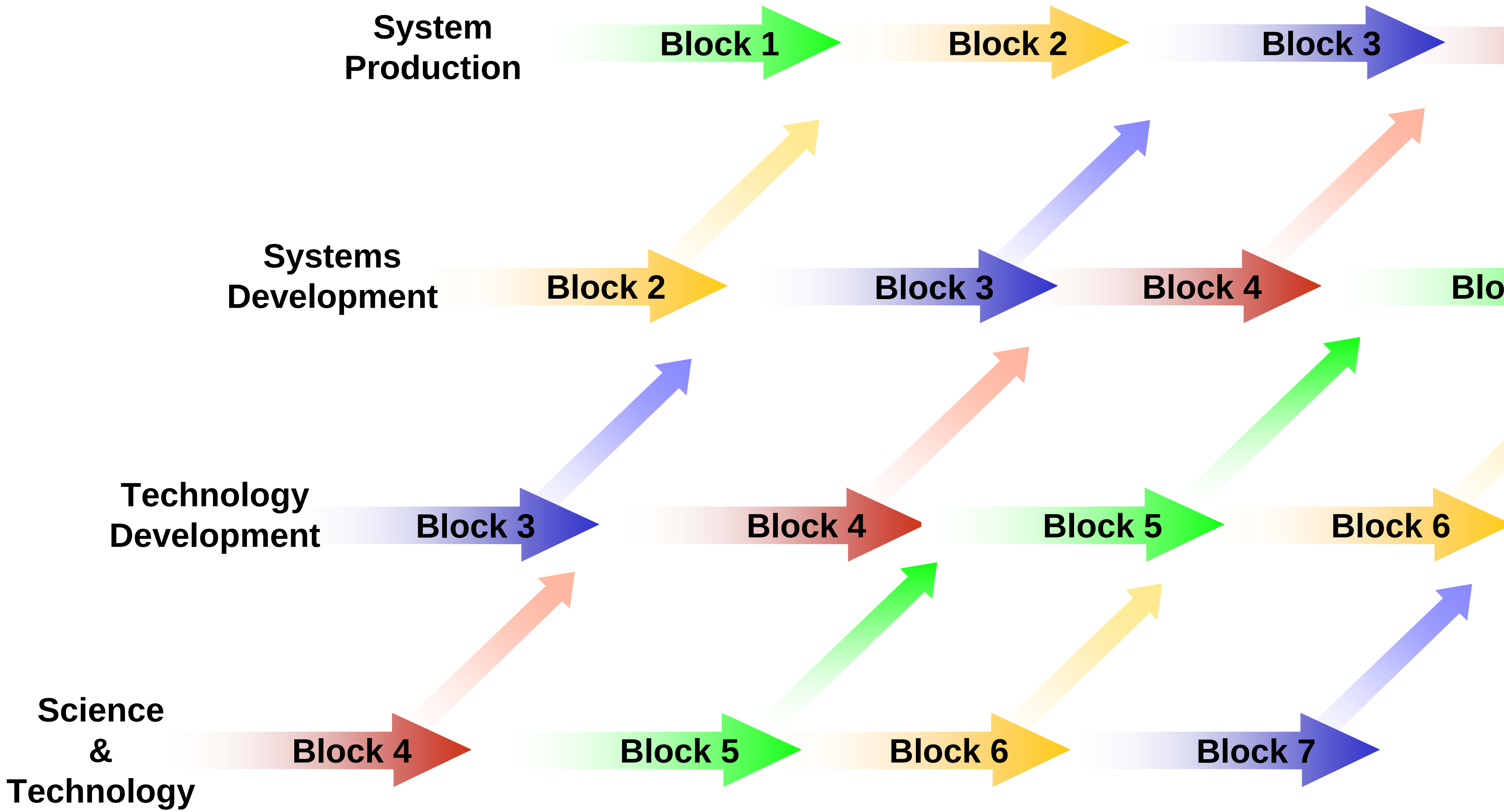
***The mission of the United States Air Force is to deliver sovereign options for the defense of the United States of America and its global interests -- to fly, fight, & win in Air, Space, and Cyberspace*.**

Back to Basics in Acquisition

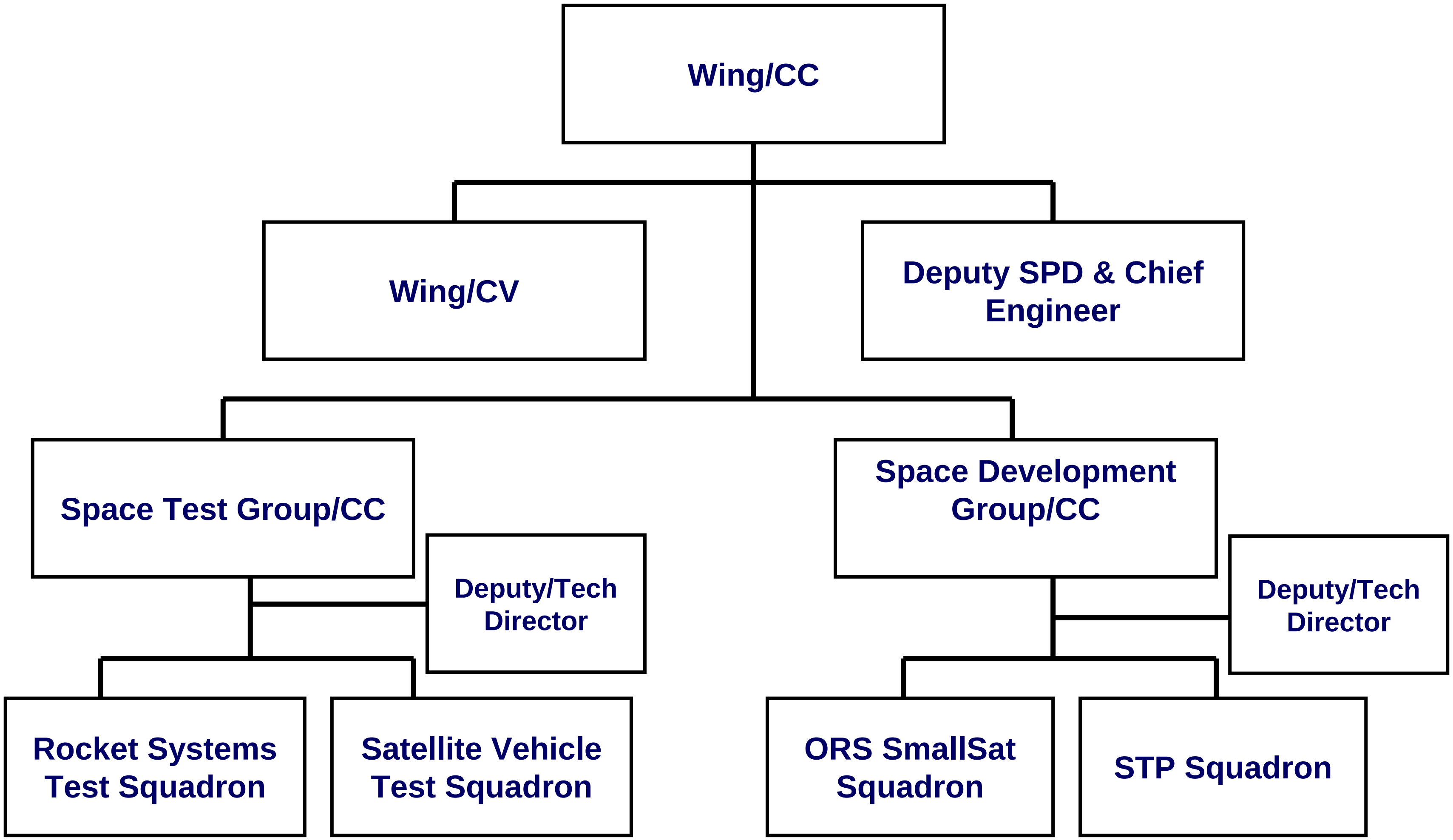
- Four-stage process
  - System Production
  - Systems Development
  - Technology Development
  - Science & Technology
- Reapportion Risk
  - Lower risk in Production
    - Use mature technology
  - Higher risk in S&T



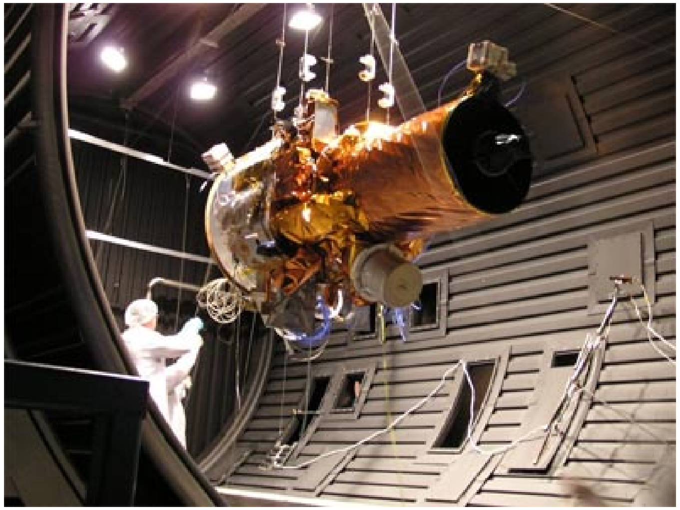
Acquisition Stages--Block Approach

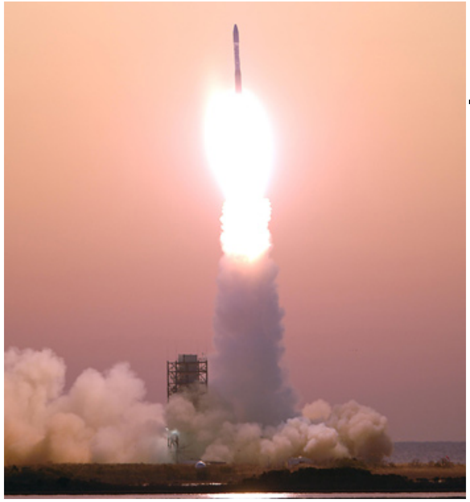


Space Development & Test Wing



Tactical Satellite (TacSat)-2 Experiment





Successful Launch, 16 Dec 06, Orbital Minotaur

Ground Terminal – China Lake

Capability:

- Field tasking/data downlink in same pass
- One meter tactical imagery
- Specific emitter ID & geolocation
- Dynamic retasking, cooperative with EP-3
- Autonomous tasking/checkout/on-orbit maintenance, on-board data processing
- Total mission cost w/ launch ~$63M

Status:

- First of TACSAT series on-orbit
- 18 month development to launch cycle
- Utilized the Minotaur launch vehicle
- Launched from Wallops Island Facility 16 Dec 2006
- Successfully commanded spacecraft from China Lake ground station

Defense Meteorological Satellite Program Launch

F-17

Launched 5 Nov 2006 on a Delta 4

Vandenberg AFB, CA

Polar Orbit

Altitude of 450 Nautical Miles

Primary Mission: To provide visible and infrared imagery of clouds, day or night

Heritage to Horizons

***General Bernard Schriever*:**

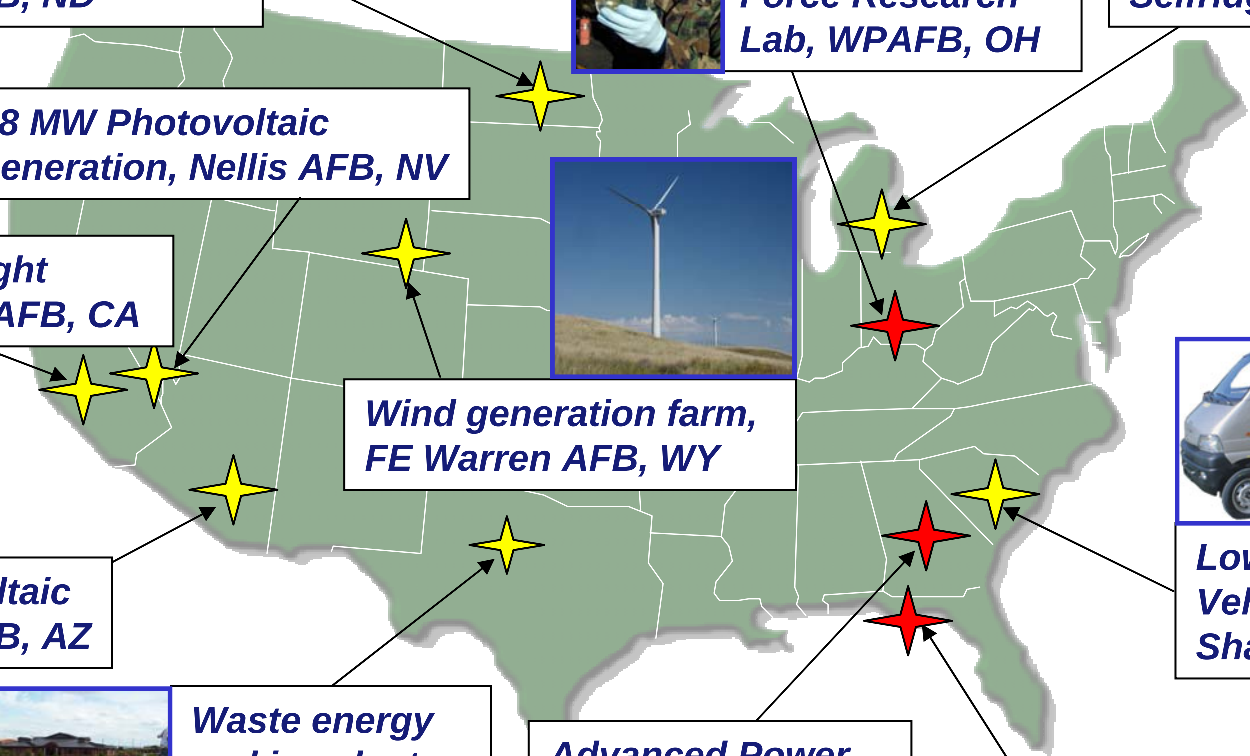
"We must strive to be first in technological accomplishments if America is to continue its growth in security, maturity and peace. That is why and how we have come from Kitty Hawk to Aerospace."

AF Energy Strategy
Addressing Supply & Demand

Make energy a consideration in all Air Force actions

- **Accelerate development and use of "Alternative" fuels**
  - **Synthetic Fuel for Aviation**
  - **Renewable Energy for Installations**
- **Enhancing energy efficiency--aviation and infrastructure**
- **Promote a culture where Airmen conserve energy**

Examples of AF Energy Initiatives in the United States



Demonstrate H_2 Production & Military Fuel Cell Vehicle Grand Forks AFB, ND

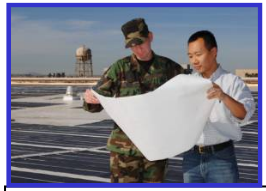
Synthetic Fuels Research, Air Force Research Lab, WPAFB, OH

Fuel Cell/Electric Warehouse Tractor Selfridge ANGB, MI

18 MW Photovoltaic generation, Nellis AFB, NV

B-52 SynFuel Flight Demo, Edwards AFB, CA

Wind generation farm, FE Warren AFB, WY



122 KW Photovoltaic project, Luke AFB, AZ

Low Speed Vehicles Shaw AFB, SC

Waste energy and ice plant, Dyess AFB, TX

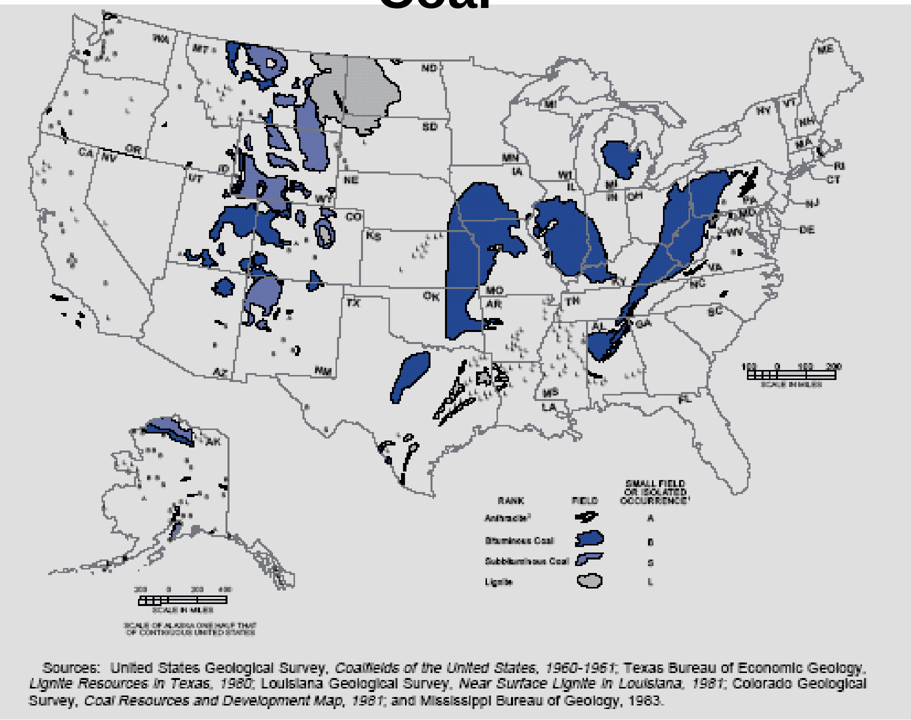
Advanced Power Technology Office, Robins AFB, GA

Air Force Energy Office, Tyndall AFB, FL

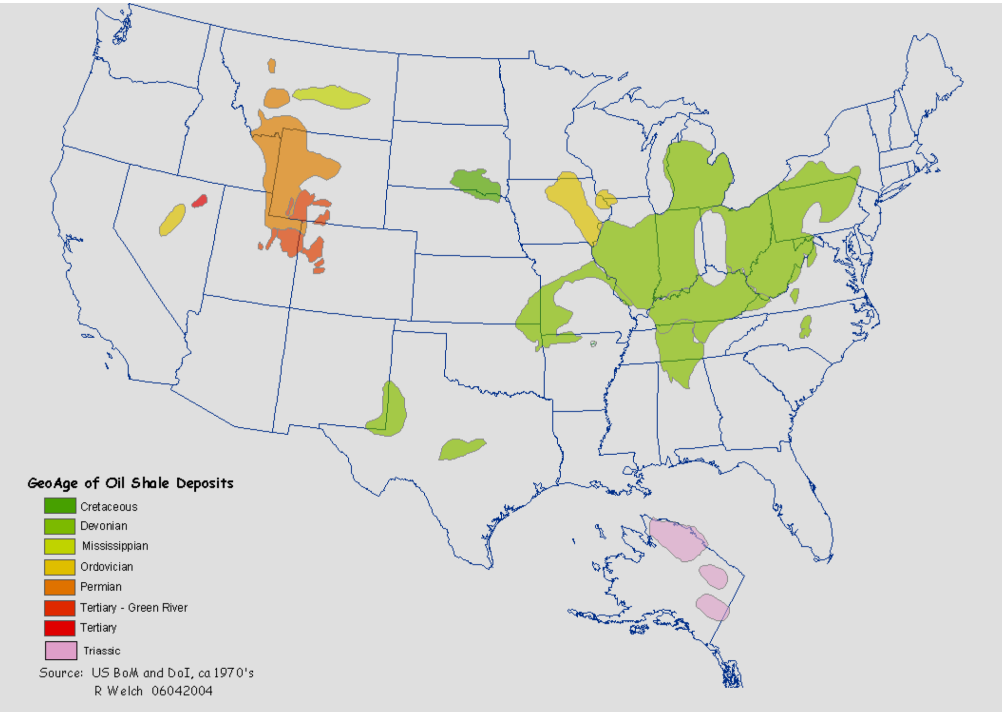
Demonstration Sites Center of Excellence

Potential US Energy Resources

Coal



Oil Shale



<u>Annual Domestic Consumption*</u>

Oil: **7.5 billion**
Natural Gas: **3.8 billion**
Coal: **.005 billion**

Total: 11.1 billion barrels equivalent

<u>Domestic Reserves*</u>

Shale: **1400 billion barrels**
Coal: **800 billion barrels of FT**
Oil: **22.7 billion barrels**

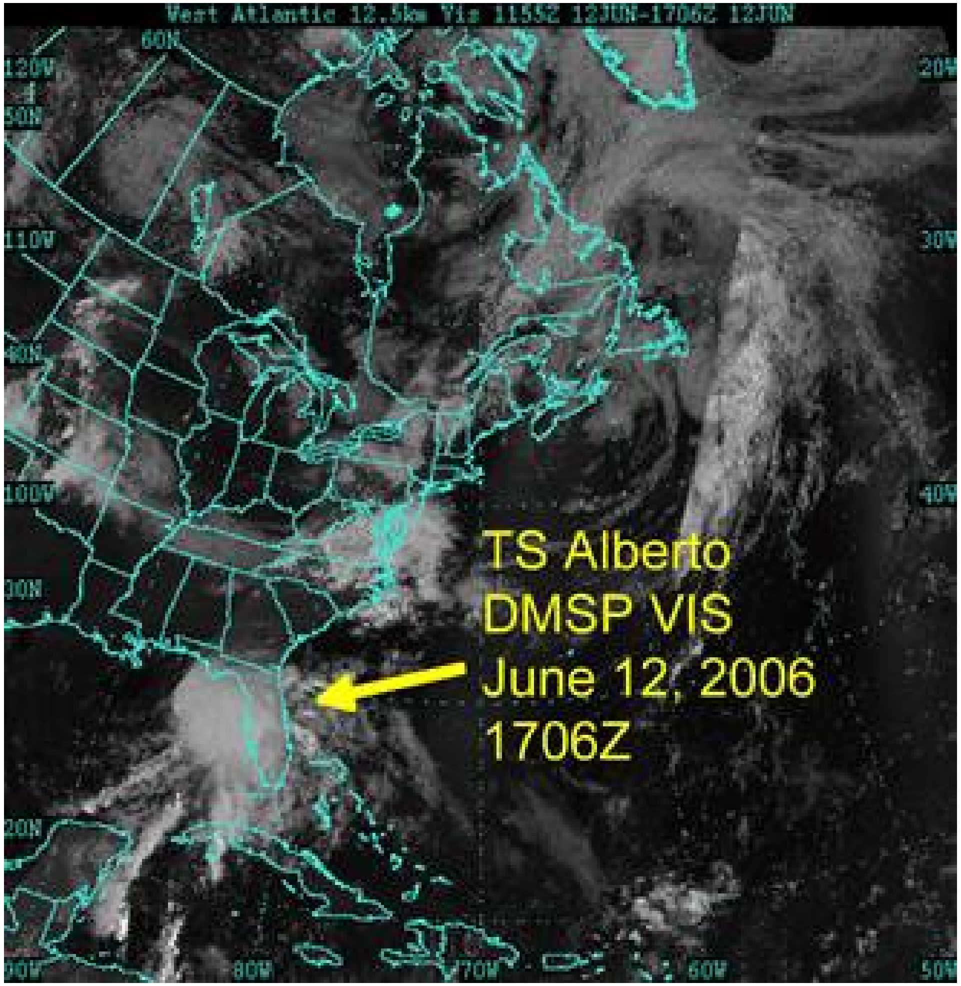
Total 2.2+ trillion barrels equivalent

* Source: DOE/Energy Information Administration, 2005

Space Program Managers' Meeting

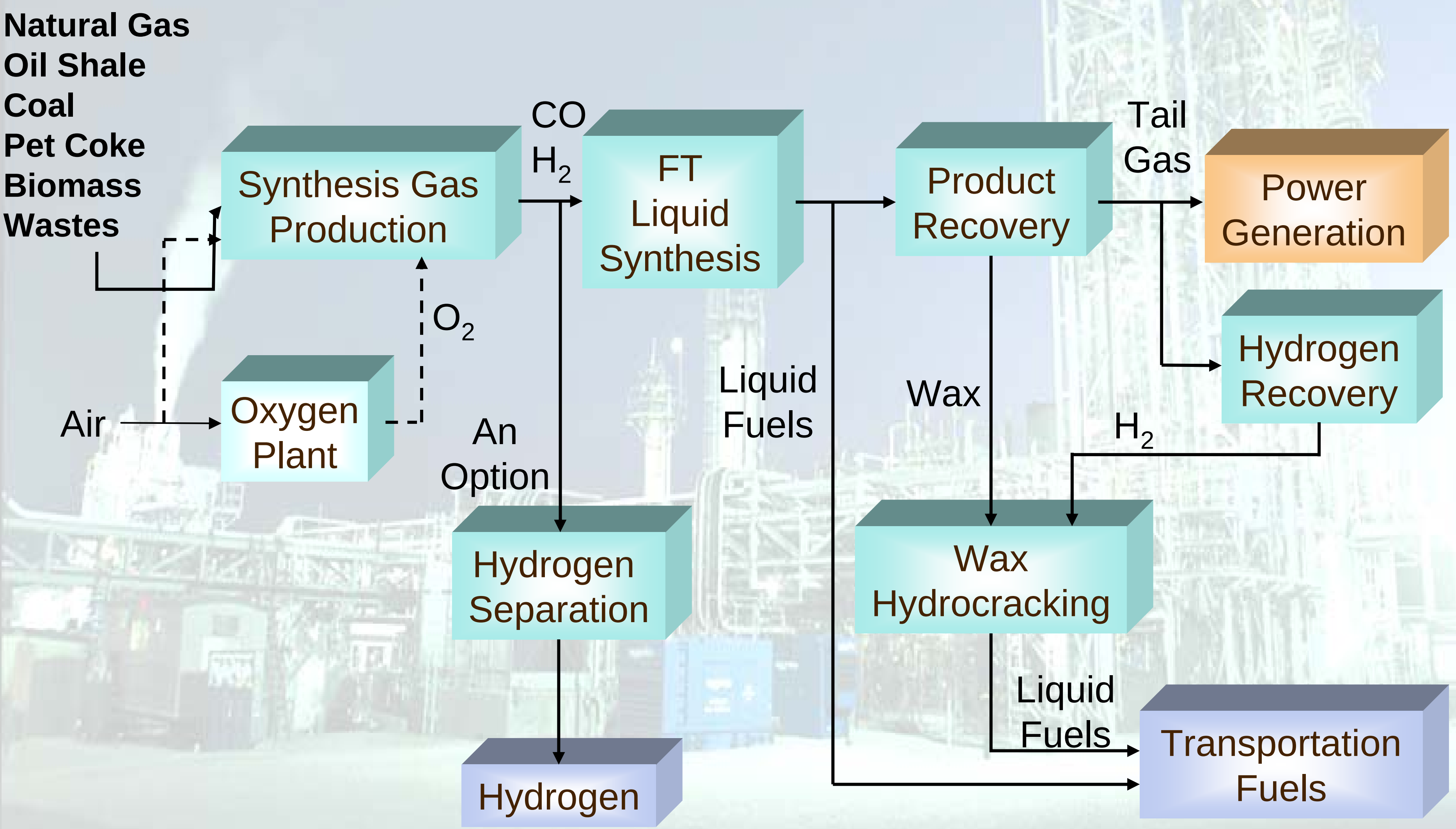
- Potential Topics
  - Integration
    - Comm Utility (Across Space, Cyber, etc.)
    - ISR (Space, Air, etc.)
  - Back to Basics
    - Increase Discipline (System Engineering, Specs / Standards, etc.)
    - Reduce Acquisition Cycle Time (RFPs, Contracts, etc.)
    - Establish Baseline—Deliver on Cost and Schedule
  - Workforce
    - Skills needed (Today and into the 21st Century)
    - Personnel Policies
- Conference Outcomes
  - Lessons Learned
  - Challenges
  - Actions

Tropical Storm Alberto

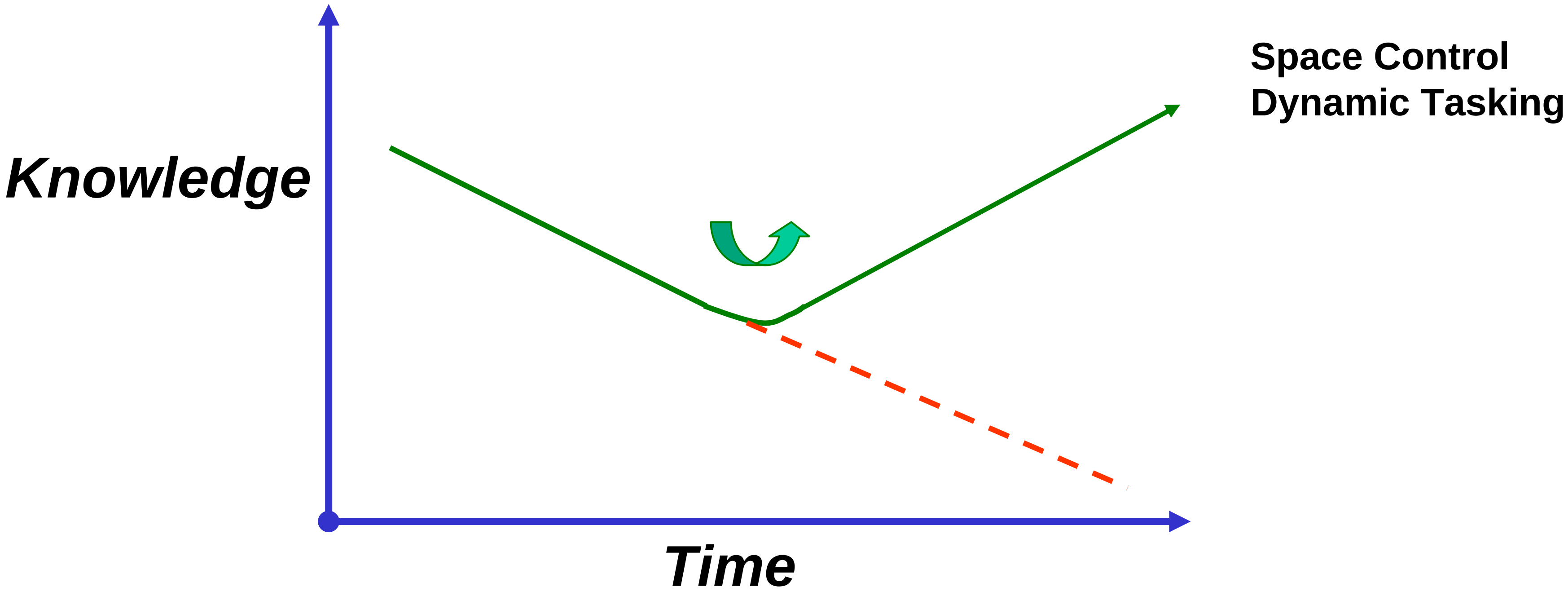


DMSP

Fischer-Tropsch Process



Space Operations in the 21st Century



- Past: Qualitative reduction in required knowledge over time due to automation and deterministic-type decisions
- Future: Increased level of knowledge required--greater judgment and cognition

GPS III Approach

Demo Cross-Link

GPS IIIA

GPS IIF cap *plus*: L1C
+10 dB
Growth Path

Demo Spot Beam

GPS IIIB

GPS IIIA *plus*
Cross-Link capability

GPS IIIC

GPS IIIB *plus*
Spot Beam capability

GPS III iCDD Addendum JROCM, signed 31 Oct 06

Commitment to Space Partnerships

Maj Gen Tom Sheridan
PEO/SPD, Space Radar
and Dep Dir, NRO

Topics of Discussion

- Collaborative Partnerships
- Multi-Agency Teamwork
- Integrating Architecture

Collaborative Partnerships

- Space Partnerships in general…
  - Focus should be on how they can and will contribute to the achievement of national and military strategy
  - Must be results oriented and created to meet core objectives

- Strategic challenges to consider
  - Selecting relevant partners; participatory collaboration and decision-making models
  - Designing partnerships to meet collective interests
  - Seek models and processes that bring diverse actors together, while allowing them to maintain their autonomy and meet their objectives

Building collaborative environments through successful partnerships is key to the success of our National Security Space Enterprise.

Importance of Multi-Agency teamwork

U.S. AIR FORCE

- **Space Radar standup "under one roof"**
  - **AF, NRO, NGA, Army, Navy and IC representatives**
  - **Close collaboration between organizations**
- **Congressional interface…."one team approach"**
  - **Ensured coordination between various SR budget lines managed by several agencies and organizations**
- **Community of Practice (COP) Forum**
  - **Created Surface Moving Target Indication (SMTI) COP**
  - **Includes SR, JSTARS program, Navy LSRS, AF Global Hawk**
  - **Implement best practices, leverages existing knowledge base, avoid potential duplication of effort, creates a valuable discussion forum**

Can't do it alone..must have "end to end" partner agency involvement for program success.

Importance of Multi-Agency teamwork

- NRO mission success is tied to multi-agency partnerships
  - Services and various agencies working together to field capabilities
  - We are still looking for better ways to integrate across the enterprise
- Director’s Strategic Framework addresses integrated efforts
  - *“Responsive to current and future needs of the Intelligence Community and DoD”*
  - *Value-added information vs. volumes of data*
  - Focus Areas Include….
    - Ground capabilities on par with collection platforms
    - Collaboration with mission partners…NSA, NGA, CIA, DIA, Services and COCOMS
    - Creating an Integrated Architecture reflective of user needs

Integrated Architecture

U.S. AIR FORCE

- NRO is pursuing two main goals:
  - Be a foundation for Global Situational Awareness
  - Provide intelligence and operational information on timelines *responsive* to user needs

- Accomplishing these goals…
  - Plan, develop, and manage with our mission partners a single integrated architecture focused on creating intelligence value for our users
    - Includes system cross-cueing, tasking, data filtering, and near-real time dissemination
  - Must have the engineering expertise, system knowledge, but most importantly…the <u>personnel</u> to accomplish the task

The aim is to promote open exchange among actors from many different sectors and backgrounds to more effectively accomplish our mission.

Questions?